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ELECTRONIC ENGINE CONTROLS (EEC-IV) SENSORS AND ACTUATORS (THROUGH MODEL YEAR 1986)

This Bulletin provides information on the many sensors and actuators used with the Ford EEC-IV System thru Model Year 1986. It is intended for use only by those technicians who are trained and skilled in electronic engine controls. Additional information on the Ford EEC-IV System is contained in the following Motorcraft Service News Bulletins:

86-48 — Ford Electronic Engine Control (EEC-IV) System Information Update (thru Model Year 1986)

85-44 — Self Testing 1983-85 EEC-IV System with An Analog Voltmeter

83-37 — Ford Electronic Engine Control (EEC-IV) System

TABLE OF CONTENTS

INTRODUCTION 2
ECA INPUT COMPONENT DESCRIPTION 3
SENSORS 3
SWITCHES 3
SIGNALS 3
EEC-IV INPUTS 3
  Air Charge Temperature (ACT) Sensor 3
  Air Conditioning — ACC, ACCS and ACD 4
  Barometric Pressure (BP) Sensor 4
  Brake On/Off (BOO) Switch 5
  Clutch Engaged Switch 5
  EGR Valve Position (EVP) Sensor 5
  Engine Coolant Temperature (ECT) Sensor 6
  Exhaust Gas Oxygen (EGO) Sensor 6
  Heated Exhaust Gas Oxygen (HEGO) Sensor 7
  Idle Tracking Switch (ITS) 7
  Ignition Diagnostic Monitor (IDM) 7
  Key Power (KPWR) 7
  Knock Sensor 8
  Manifold Absolute Pressure (MAP) Sensor 8
  Neutral Drive Switch (NDS) 8
  Neutral Gear Switch 9
  Neutral Pressure Switch (NPS) 9
  Power Steering Pressure Switch (PSPS) 9
  Pressure Feedback Electronic EGR (PFE) Transducer 9
  Profile Ignition Pickup (PIP) 9
  Self-Test Input (STI) 11
  Throttle Position (TP) Sensor 11
  Transmission Hydraulic Switches 4-3/3-2 (THS 4-3/3-2) 11
  Vane Airflow (VAF) Sensor 12
  Vane Air Temperature (VAT) Sensor 12
  Vehicle Speed Sensor (VSS) 13
INPUT SUMMARY 13
OUTPUT COMPONENT DESCRIPTION 13
  Electrical Solenoids 13
  Electric Motors 13
  Controller Modules 14
  Other ECA Outputs 14
EEC-IV OUTPUTS 14
  Boost Control Solenoid 14
  Canister Purge (CANP) Solenoid 14
  Converter Clutch Override (CCO) Solenoid 14
  Data Output Link 15
  EGR Shutoff Solenoid and EGR On/Off Solenoid 15
  EGR Vacuum Regulator (EVR) Solenoid 16
  Electro-Drive Fan (EDF) and High Electro-Drive Fan (HEDF) 16
  Exhaust Gas Recirculation Control and Vent Solenoids (EGRC/EGRV) 17
  Exhaust Heat Control (EHC) Solenoid 18
  Feedback Control (FBC) Solenoid 18
  Fuel Pump Relay 19
  Inlet Air Solenoid (IAS) 19
  Fuel Injector Solenoid — High Pressure 19
  Fuel Injector Solenoid — Low Pressure 20
  DC Motor Idle Speed Control (ISC) 20
  Locking Upshift Solenoid (LUS) 21
  Spark Output (SPOUT) 22
  Self-Test Output (STO) 22
  Thermactor Air Bypass/Diverter (TAB/TAD) Solenoids 22
  Temperature-Compensated Accelerator Pump (TCP) Solenoid 22
  Throttle Air Bypass Valve 22
  Vehicle Speed Control Solenoids 23
  Variable Voltage Choke (VVC) 23
  WOT A/C Cutout (WAC) 24
OUTPUT SUMMARY 24
CROSS REFERENCE PARTS LISTING 25

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ELECTRONIC ENGINE CONTROLS (EEC-IV) SENSORS AND ACTUATORS (THROUGH MODEL YEAR 1986)

INTRODUCTION

This text will describe the various sensors and actuators used with the EEC-IV system and explain how they operate. It is designed to help the technician identify and understand these components before attempting to correct a driveability concern. For complete EEC Diagnosis and Testing procedures refer to the "Emission Diagnosis/Engine Electronics Shop Manual, Volume H (Fig. 1). The manual may be purchased from Helm Inc., P.O. Box 07150, Detroit, Michigan 48207.

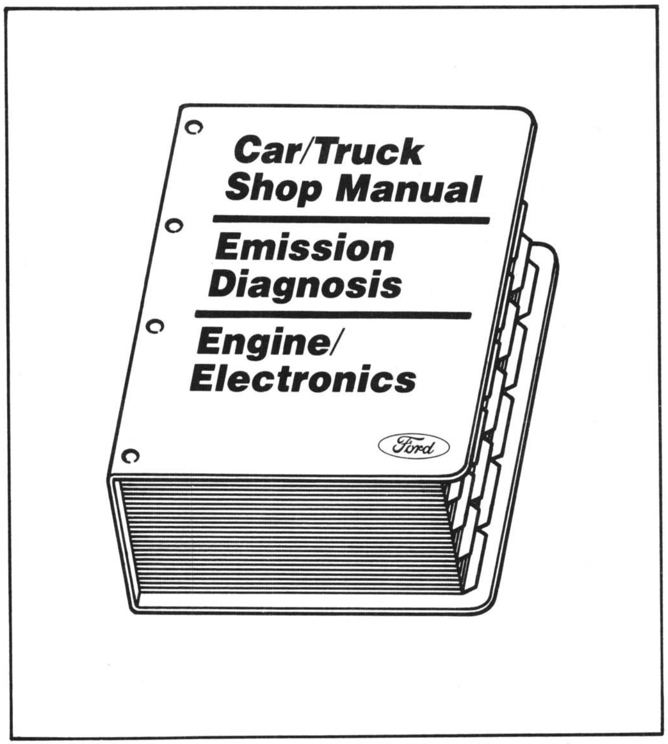

Figure 1. Emissions Diagnosis/Engine Electronics Shop Manual, Volume H.

NOTE:

The key to making accurate diagnoses of engine performance problems on a vehicle equipped with EEC-IV is to approach the vehicle as if it **is not** equipped with the EEC-IV system. In the days before engine controls, a technician would look the engine over thoroughly and perform certain diagnostic routines to determine the problem. The addition of engine controls has not changed the basic structure or operation of the engine. All the visual checks and diagnostic routines still apply, and are quite necessary. There is absolutely no sense looking to the EEC-IV system for a problem if the problem exists somewhere outside the system.

The EEC-IV system is the fifth generation of electronic engine controls (including the MCU system) developed and produced by the Ford Motor Company. In the past, an engine's air/fuel mixture, ignition and emissions systems were controlled by independently functioning vacuum and/or mechanical devices. With the EEC-IV System, these processes can now be controlled by a small on-board computer known as the electronic control assembly (ECA). This integrated control provides for optimal engine performance and driveability, maximum fuel efficiency, and minimum noxious emissions under any operating condition. In order to control all of these different processes that are part of the engine control system, the EEC-IV system must have the ability to monitor each process individually. In addition, the EEC-IV system also needs devices which allow it to control these processes. The EEC-IV system allows the ECA to read and evaluate signals it receives from each of its **system inputs.** The ECA uses those same signals as the basis for commands sent to **system outputs** (Fig. 2).

- **System inputs** are sensors that transmit signals to the ECA. These signals indicate what is taking place at key locations in and around the engine.
- **System outputs** are actuating devices that perform a specific function whenever the ECA signals them.

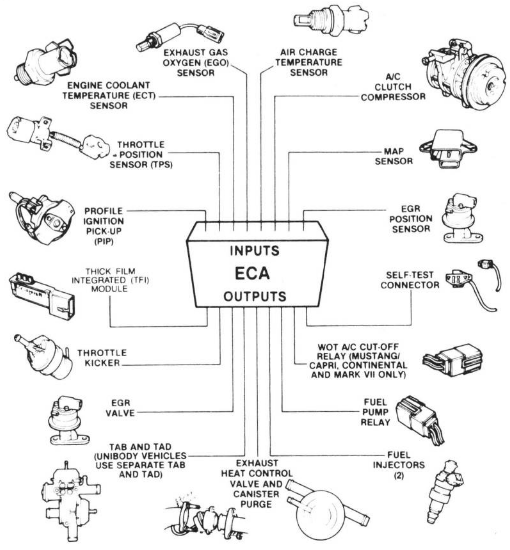
EXHAUST GAS OXYGEN (EGO) SENSOR
AIR CHARGE TEMPERATURE SENSOR
ENGINE COOLANT TEMPERATURE (ECT) SENSOR
A/C CLUTCH COMPRESSOR
THROTTLE POSITION SENSOR (TPS)
MAP SENSOR
PROFILE IGNITION PICK-UP (PIP)
EGR POSITION SENSOR
INPUTS
ECA
OUTPUTS
THICK FILM INTEGRATED (TFI) MODULE
SELF-TEST CONNECTOR
THROTTLE KICKER
WOT A/C CUT-OFF RELAY (MUSTANG/ CAPRI, CONTINENTAL AND MARK VII ONLY)
EGR VALVE
FUEL PUMP RELAY
TAB AND TAD (UNIBODY VEHICLES USE SEPARATE TAB AND TAD)
EXHAUST HEAT CONTROL VALVE AND CANISTER PURGE
FUEL INJECTORS (2)

Figure 2. ECA Inputs and Outputs

ELECTRONIC ENGINE CONTROLS (EEC-IV) SENSORS AND ACTUATORS (THROUGH MODEL YEAR 1986)

ECA INPUT COMPONENT DESCRIPTION

The ECA input system is comprised of a variety of components, specifically designed to monitor an operating function of the vehicle. These components are divided into three main categories:

- Sensors
- Switches
- Signals

SENSORS

Sensors inform the ECA of the current operating status of a vital engine function such as throttle angle. Sensors usually receive or send some type of voltage change to the ECA. EEC-IV system sensors include:

- Thermistors
- Potentiometers
- Signal generators
- Hall effect devices
- Inductive pickups
- E-cells

SWITCHES

Switches are different from sensors. As well as being components of the ECA, switches can be an integral part of other systems such as the brake ON/OFF (BOO) switch. Switch inputs are digital (the component is either ON or OFF). The ECA monitors the following with a digital input:

- Air conditioning
- Brake ON/OFF
- Idle tracking
- Transmission (automatic or manual)
- Clutch
- Power steering

SIGNALS

Signals are also an input to the ECA. A signal is used by the ECA to determine certain modes of operation. Signals are associated with an ECA testing feature. The following signals are used by the ECA:

- Ignition diagnostic monitor (IDM)
- Self-test input (STI)

EEC-IV INPUTS

The following inputs to the EEC-IV system are listed in alphabetical order. Not all of these inputs are used on any one vehicle.

Air Charge Temperature (ACT) Sensor

The ACT is a specialized thermistor which changes resistance according to air temperature. As the air temperature increases, the ACT resistance decreases. This information is necessary for the ECA to compensate ignition timing and air/fuel ratio due to a change in air density. The sensor is usually located in the intake manifold runner or air cleaner housing (Fig. 3).

ELECTRONIC ENGINE CONTROLS (EEC-IV) SENSORS AND ACTUATORS (THROUGH MODEL YEAR 1986)

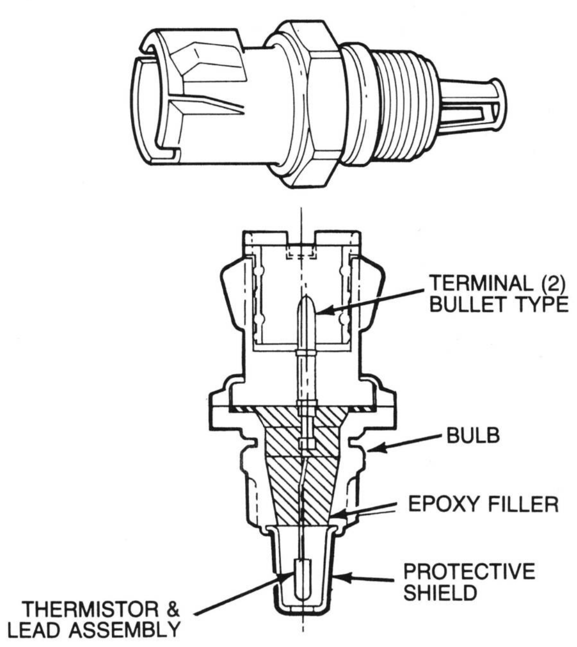

Figure 3. Air Charge Temperature Sensor

Air Conditioning — ACC, ACCS and ACD

Each time battery voltage is applied to the A/C clutch, a signal is sent to the ECA. The ECA then maintains the engine idle speed with the throttle air bypass valve solenoid or idle speed control (ISC) motor to compensate for the added load created by the A/C operation.

Shutting off the air conditioning has a reverse effect. The ECA maintains the engine idle speed to correct curb idle specification (Fig. 4).

Barometric Pressure (BP) Sensor

An EEC-IV vehicle that does not incorporate a manifold absolute pressure (MAP) sensor monitors barometric pressure through the use of a BP sensor (Fig. 5).

The barometric sensor supplies ECA information to compensate for altitude variations. The ECA modifies certain outputs as a result of barometric pressure changes. The barometric pressure sensor produces a frequency based on atmospheric pressure.

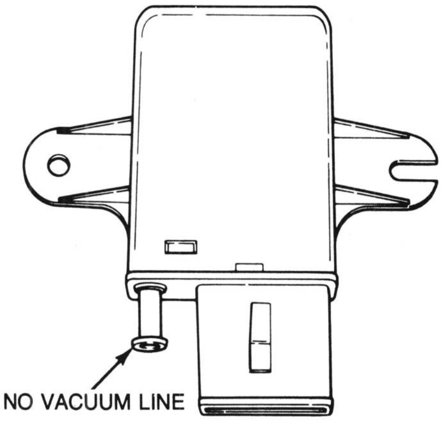

Figure 5. Barometric Pressure Sensor

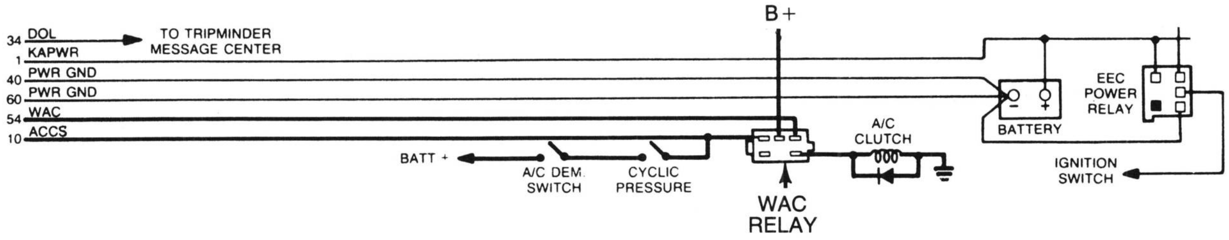

Figure 4. Air Conditioning/EEC Schematic

ELECTRONIC ENGINE CONTROLS (EEC-IV) SENSORS AND ACTUATORS (THROUGH MODEL YEAR 1986)

Brake On/Off (BOO) Switch

The BOO switch is a 12-volt signal from the brakelamp switch to the ECA. This information is used to determine vehicle status. Vehicle speed control and converter clutch lockup operation are controlled according to this input. The BOO switch signal is a digital input (either on or off) (Fig. 6).

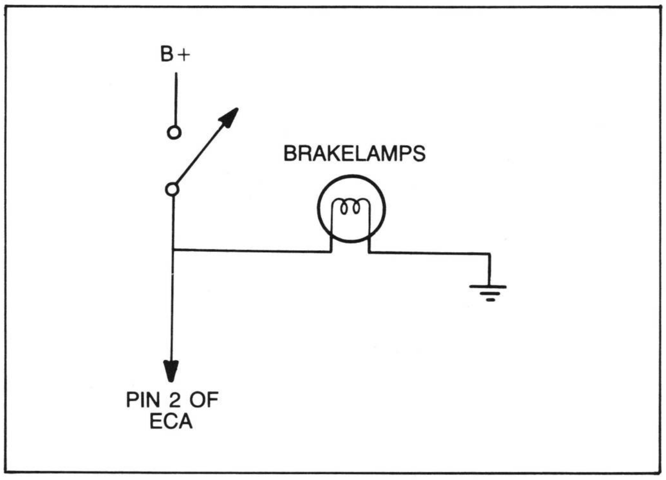

Figure 6. BOO Input Schematic

Clutch Engaged Switch

On models equipped with a manual transmission, two switches connected in parallel indicate a vehicle load or no-load condition to the ECA. These are the clutch engaged switch and the neutral gear switch (Fig. 7).

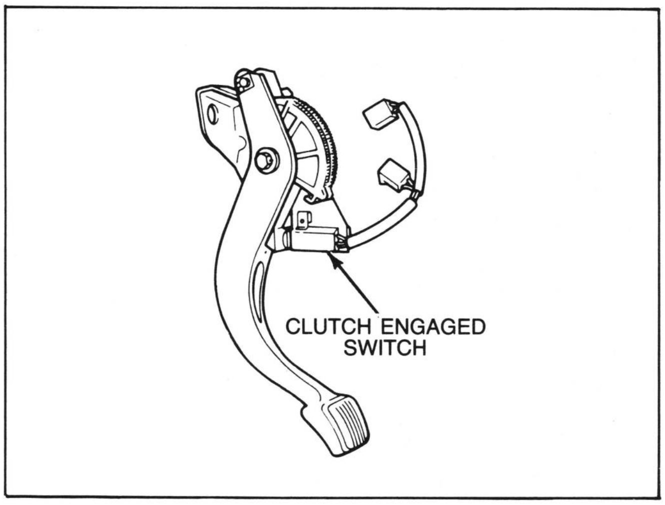

Figure 7. Clutch Engaged Switch and Neutral Gear Switch

The clutch engaged switch is a two-position switch that is closed when the clutch is depressed. It is mounted on the clutch pedal lever.

The neutral gear switch is located on the manual transmission and is connected to the shift linkage. The transaxle neutral switch is a microswitch that is closed when the transaxle is in the NEUTRAL position.

These switches are necessary to prepare the ECA for vehicle load during operation. Figure 8 details a typical clutch engaged/neutral gear schematic.

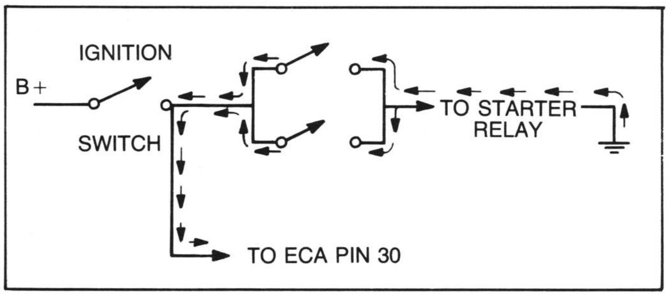

Figure 8. EEC/Manual Transmission Electrical Schematic

EGR Valve Position (EVP) Sensor

The EVP sensor (Fig. 9) provides the ECA with a signal indicating the position of the EGR valve pintle. It is mounted on top of the EGR valve.

The EVP sensor is a linear potentiometer. The wiper on the potentiometer is mechanically moved by an actuator rod which rests on the EGR valve stem.

As the EGR valve opens and closes, the stem moves the sensor shaft/wiper assembly an amount equal to the position of the valve.

Resistance range of the EVP sensor is 3,000 to 5,000 ohms with the sensor disconnected from the wiring harness. With the EGR valve at maximum open, the signal to the ECA is approximately 86% of reference voltage. At maximum closed, the signal is approximately 16% (or 8% depending on application) of reference voltage. Between maximum open and closed positions the signal is proportional.

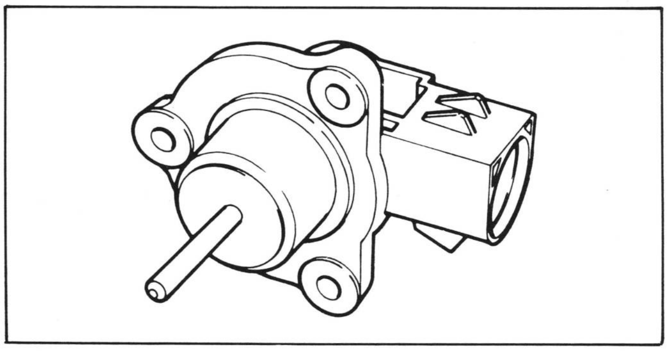

Figure 9. EVP Sensor

ELECTRONIC ENGINE CONTROLS (EEC-IV) SENSORS AND ACTUATORS (THROUGH MODEL YEAR 1986)

Engine Coolant Temperature (ECT) Sensor

The ECT sensor (Fig. 10) measures the coolant temperature of the engine. The sensor is threaded into the engine coolant passage.

The ECT sensor contains a thermistor; a device in which resistance changes with temperature. This sensor is very similar to the ACT sensor.

The electrical resistance of the thermistor decreases as temperature increases, and increases as temperature decreases. The varying resistance affects the voltage drop across the sensor terminals and provides electrical signals to the ECA corresponding to engine temperature. A cold engine results in a high electrical signal. A normal engine operating temperature results in a lower electrical signal. The change in resistance is not proportional to the change in temperature.

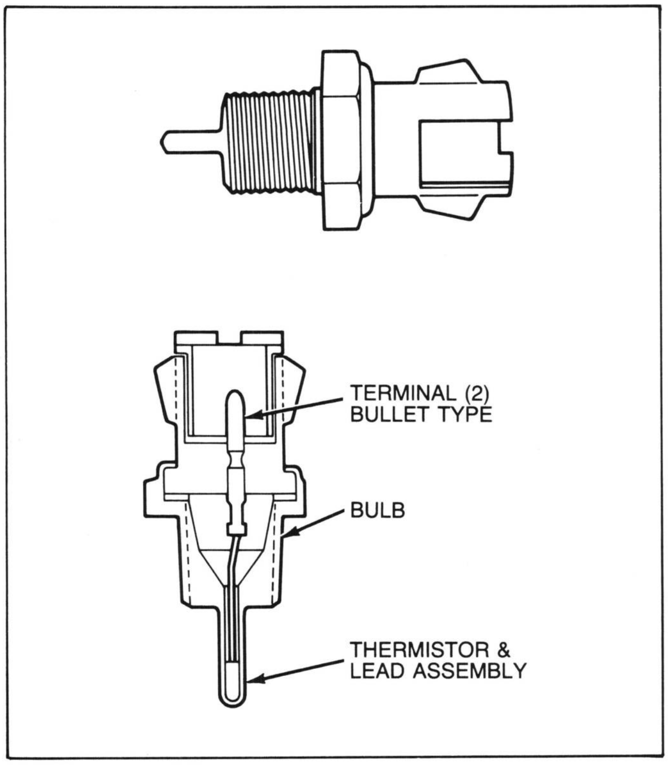

Figure 10. ECT Sensor

Exhaust Gas Oxygen (EGO) Sensor

The EGO sensor is situated in its own mounting boss in the exhaust manifold (Fig. 11). It operates between approximately a zero- and one-volt output, depending on the presence (lean) or absence (rich) of oxygen in the exhaust gas.

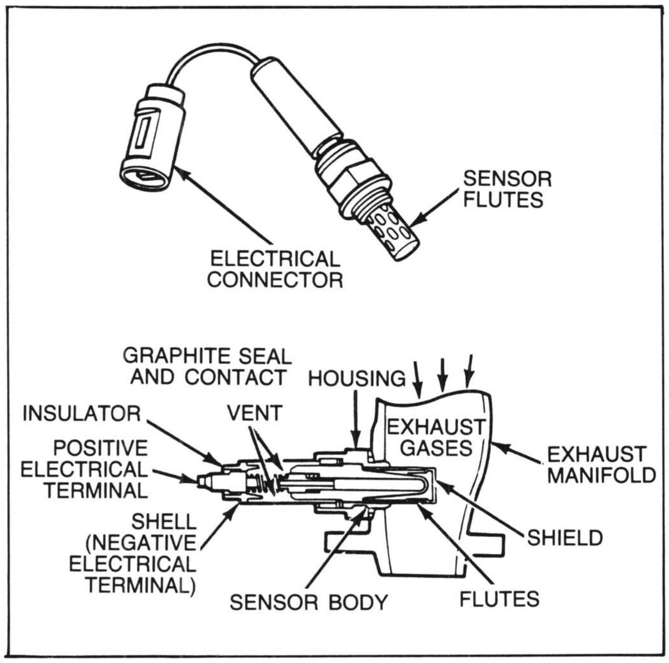

Figure 11. EGO Sensor

The sensor protrudes directly into the path of exhaust gases. The gases enter flutes in the shield and contact the sensor element.

The EGO sensor flutes allow exhaust gas to move continuously around the sensor element.

The EGO sensor produces a voltage source during operation. Lean of stoichiometric (balanced) air/fuel ratio, the EGO sensor will output a voltage between zero to 0.40 volt. Rich of stoichiometric, the EGO sensor will output a voltage between 0.60 to 1.0 volt at EGO tip temperature of 350°C (662°F).

A voltage reading greater than 0.6 volt indicates a rich air/fuel ratio, while a reading of less than 0.4 volt indicates a lean ratio.

The EGO signal positive lead is to the ECA. Ground is through the exhaust manifold and engine block. From the ECA is an additional ground, circuit 89 (ECA pin 49).

The EGO signal is zero until it warms (lean). During cold-engine operation, the ECA ignores the EGO signal.

NOTE: The operating temperature of the EGO sensor is between 300-850°C (572-1,562°F).

NOTE: The EGO sensor should never be tested with anything other than a digital voltmeter.

ELECTRONIC ENGINE CONTROLS (EEC-IV) SENSORS AND ACTUATORS (THROUGH MODEL YEAR 1986)

Heated Exhaust Gas Oxygen (HEGO) Sensor

On certain vehicles the exhaust gas oxygen sensor incorporates an internal heater. The HEGO sensor operates in the same manner as an EGO sensor. With the addition of an internal heater, a longer closed-loop operation is possible during periods of idle.

Battery voltage is applied to the heating element when the ignition switch is in the RUN position only (Fig. 12).

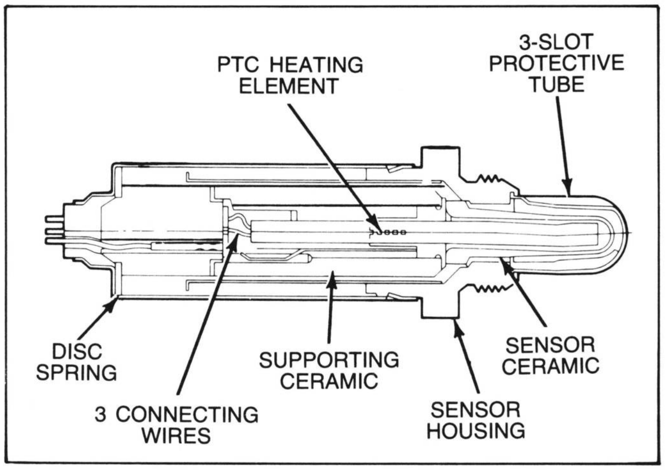

Figure 12. HEGO Sensor

Idle Tracking Switch (ITS)

The ITS (Fig. 13), used on certain applications, is integral with the DC motor idle speed control (ISC). The ITS signals the ECA when the throttle is open (switch is closed) and not in contact with the DC motor idle speed control plunger. The voltage signal to the ECA is less than one volt. When the throttle lever is in contact with the switch, the switch opens and a voltage signal is sent to the ECA.

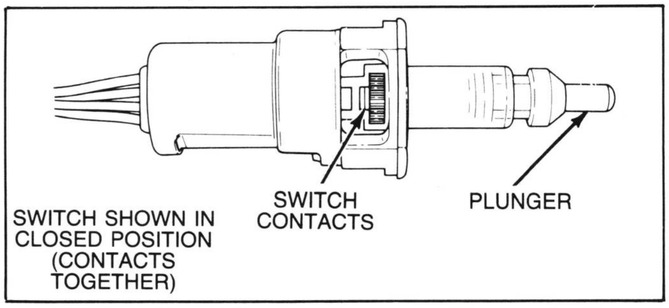

Figure 13. Idle Tracking Switch

Ignition Diagnostic Monitor (IDM)

The IDM circuit is an ECA input from the negative terminal of the ignition coil. The input is designed as a comparison reference, enabling the ECA to determine if the ignition primary circuit has an intermittent fault. When the ECA has observed a PIP signal and has submitted a SPOUT signal to the TFI-IV module, a resultant signal should be observed at the IDM terminal of the ECA. Failure to monitor the ignition coil signal results in the ECA setting an intermittent failure code into memory. This allows the technician more diagnostic leverage when attempting to service the vehicle (Fig. 14).

Key Power (KPWR)

On applications with a DC motor idle speed control (ISC), when the key ON signal is stopped, the ECA cycles the ISC plunger to prevent dieseling, and then extends for the next start-up within 10 seconds.

On applications with a throttle air bypass valve solenoid (multi-point, fuel injected engines), the key on input, along with the crank input, signals the ECA to go to a 100% duty cycle on the solenoid. This allows for "no-touch" engine starting, since the solenoid allows air to flow around the closed throttle plate(s) (Fig. 15).

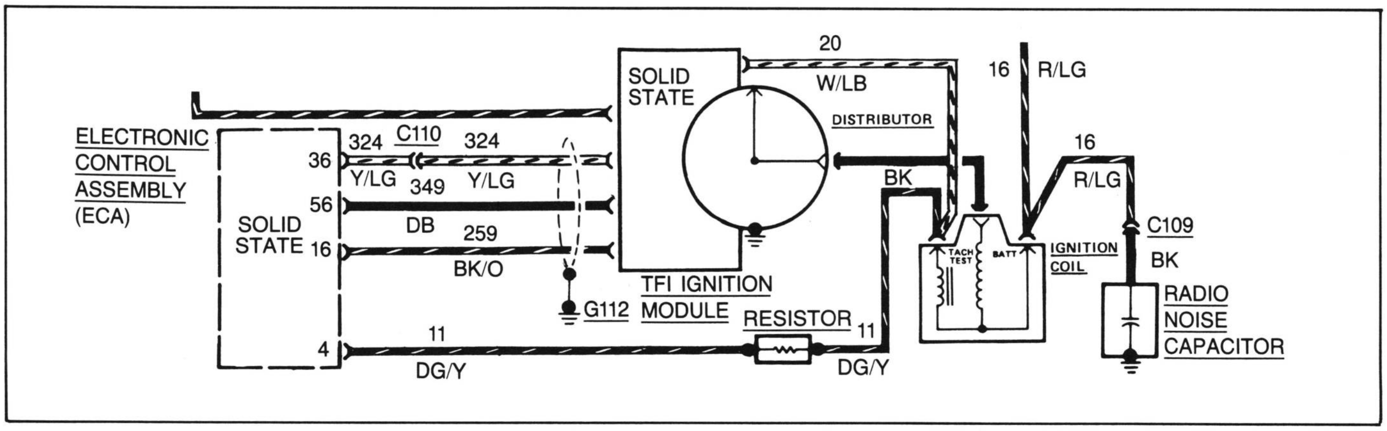

Figure 14. Ignition Diagnostic Monitor (IDM) Schematic

ELECTRONIC ENGINE CONTROLS (EEC-IV) SENSORS AND ACTUATORS (THROUGH MODEL YEAR 1986)

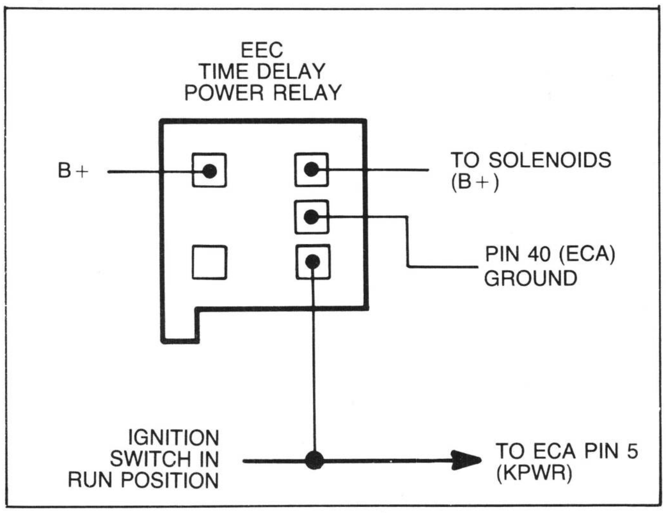

Figure 15. Key Power (KPWR) Schematic

Knock Sensor

The knock sensor (Fig. 16) is an accelerometer: an electronic device capable of measuring vibration and converting the vibration signal to an electrical output that measures the engine knock. The sensor is designed to resonate at the same frequency as engine spark knock (5-6 kHz). The accelerometer converts the vibration signal to an electrical output.

The output of the knock sensor is used by the ECA to retard ignition timing.

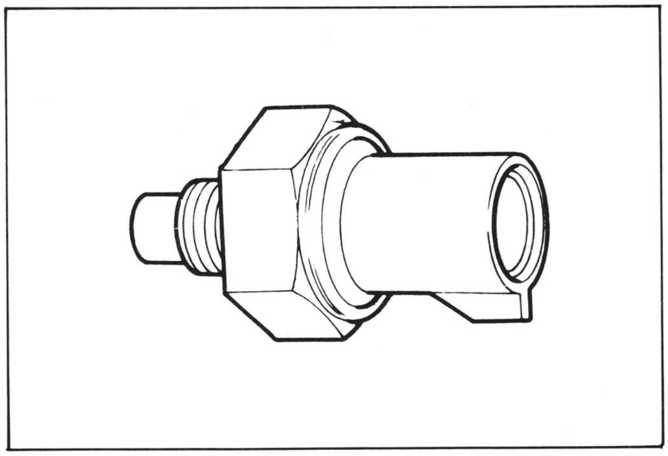

Figure 16. Knock Sensor

Manifold Absolute Pressure (MAP) Sensor

The MAP sensor operates as a piezoelectric disc capacitor, except that the output signal has a frequency changed, rather than voltage. The pressure-sensing element has a sealed vacuum reference input on one side of a diaphragm in the silicon sensing element, and manifold or barometric pressure on the other side. Any changes in pressure result in a corresponding change in the diaphragm deflection and, therefore, a change in capacitance. The capacitance of the pressure-sensing element increases with increased pressure.

The MAP sensor (Fig. 17) is connected to the intake manifold by way of a vacuum hose. The signal from the MAP sensor to the ECA allows the ECA to determine under what load the engine is operating. During periods of Key On/Engine Off and at wide-open throttle acceleration, the MAP sensor signals barometric pressure to the ECA.

The frequency range of the MAP is 88-163.80 Hz.

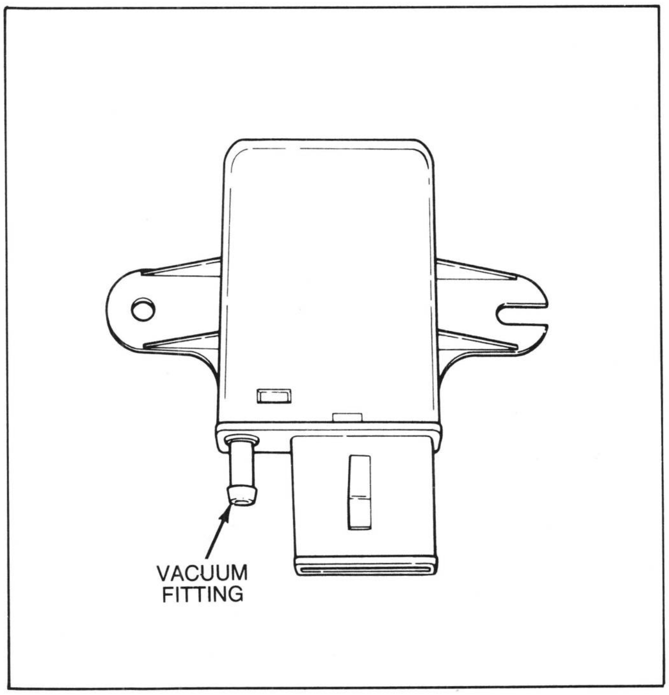

Figure 17. Manifold Absolute Pressure (MAP) Sensor

Neutral Drive Switch (NDS)

The NDS provides a signal indicating when the automatic transmission is in NEUTRAL. This allows the ECA to determine the engine load (transmission in gear).

No voltage (one volt or less) on the line (switch closed) is an indication that the transmission is in PARK or NEUTRAL.

The ECA adjusts the engine idle speed for the load or no-load condition. A neutral forcing relay is energized in the START mode to provide the no-voltage signal on the Vref line (Fig. 18).

ELECTRONIC ENGINE CONTROLS (EEC-IV) SENSORS AND ACTUATORS (THROUGH MODEL YEAR 1986)

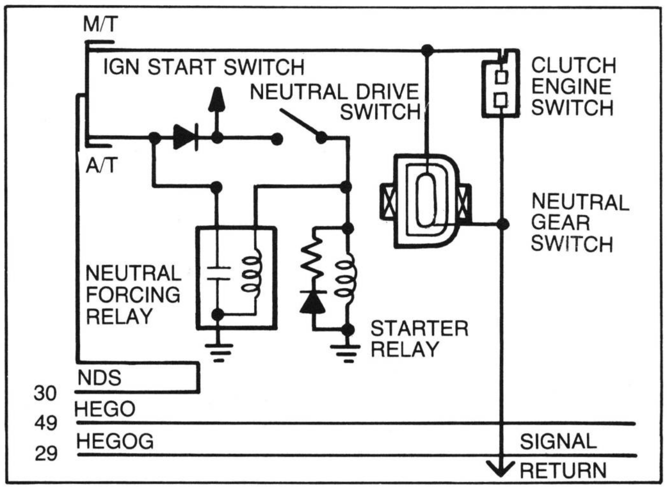

Figure 18. Neutral Drive Switch Schematic

Neutral Gear Switch

Refer to Clutch Engaged Switch for operation of the neutral gear switch.

Neutral Pressure Switch (NPS)

The NPS is used only on the AXOD transaxle. The switch is hydraulically operated and informs the ECA of gear selection. The NPS is used with the transmission hydraulic switches 4-3 and 3-2 (THS 4-3 and THS 3-2). It is mounted to the valve body of the transaxle in the forward clutch hydraulic circuit (Fig. 19).

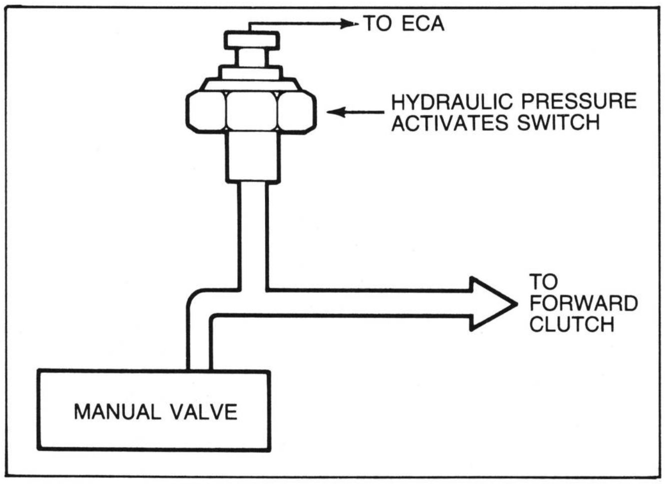

Figure 19. Neutral Pressure Switch

Power Steering Pressure Switch (PSPS)

The PSPS is used on certain vehicle applications to signal, through circuit 330 to pin 30 of the ECA, when power steering pressure exceeds a specified limit (400-600 psi). The ECA will then adjust idle speed to compensate for this added load on the engine. The switch is located in the high-pressure line of the power steering system.

Pressure Feedback Electronic EGR (PFE) Transducer

The PFE transducer relays information related to exhaust pressure. The processor uses the PFE inputs to determine the correct opening position of the EGR valve for increased NO_x control (Fig. 20).

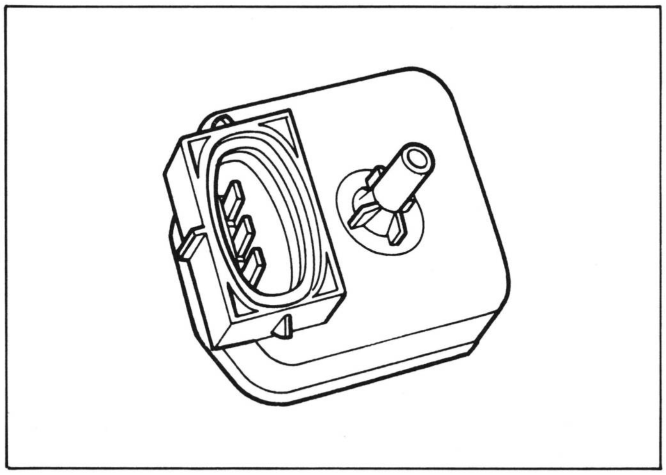

Figure 20. PFE Transducer

Profile Ignition Pickup (PIP)

The PIP is located in the universal distributor. The primary function of the EEC-IV universal distributor is to direct the high secondary voltage to the spark plugs. In addition, the universal distributor supplies crankshaft position and frequency information to the ECA using the PIP sensor. The distributor does not have a mechanical or vacuum advance. The universal distributor assembly is adjustable for resetting base timing, if required.

The PIP sensor (Fig. 21) has an armature, with windows and metal tabs, that rotates past the pickup assembly (Hall effect switch). When a metal tab enters the stator assembly, a signal is sent to the ECA, indicating the 10° BTDC crankshaft position. The ECA calculates the precise time to energize the spark output signal to the TFI module. When the TFI module receives the spark output signal, ignition coil primary current flow is stopped, causing the collapse of the magnetic field. This results in a high-voltage induction in the secondary winding firing the spark plug.

Misadjustment of base timing affects spark advance amounts in the same manner as a conventional ignition system.

ELECTRONIC ENGINE CONTROLS (EEC-IV) SENSORS AND ACTUATORS (THROUGH MODEL YEAR 1986)

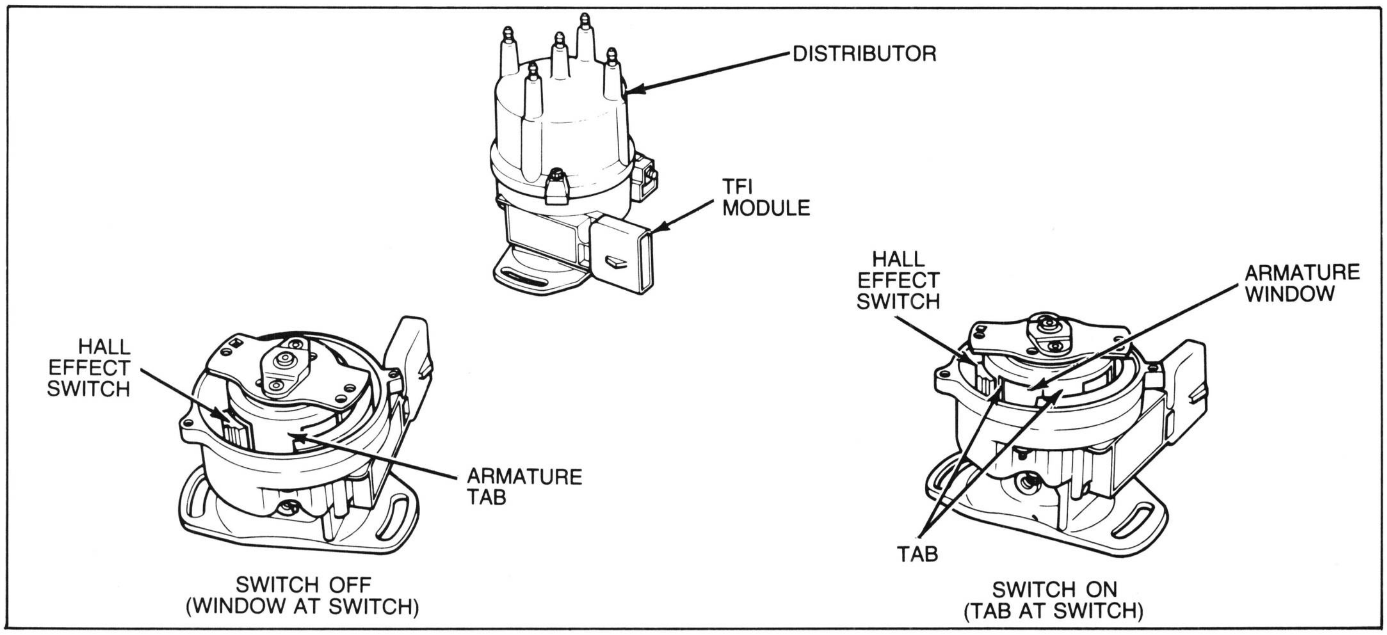

Figure 21. PIP Sensor and Universal Distributor

The 5.0L sequential electronic fuel injection (SEFI) system incorporates a unique trigger armature for fuel/ignition synchronization. The ECA must be able to determine which PIP signal is the No. 1 cylinder. One tab on the armature is narrower than the others, causing a different signal. This is referred to as a signature PIP signal. The signal is necessary due to the energizing of each injector in relation to the engine firing order (Fig. 22).

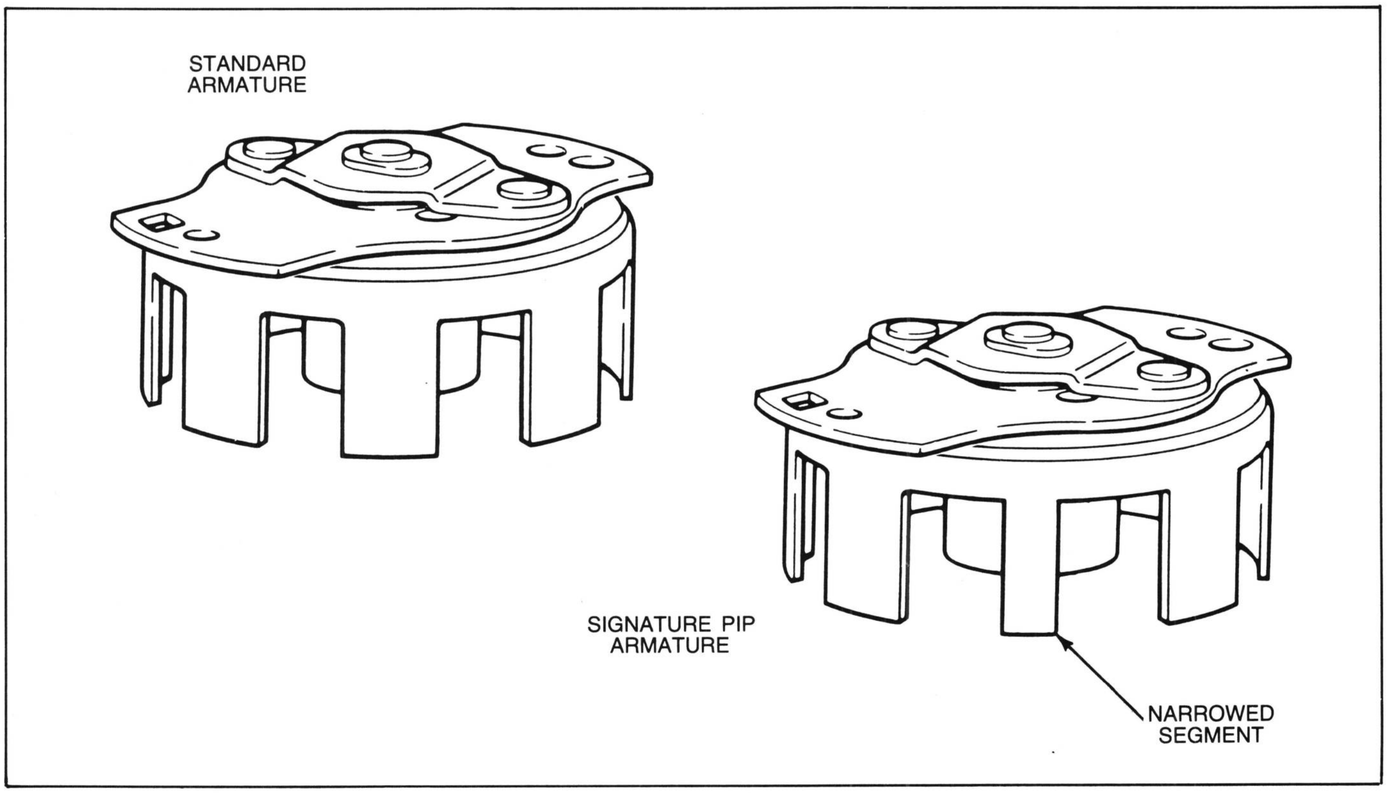

Figure 22. Signature PIP Armature

ELECTRONIC ENGINE CONTROLS (EEC-IV) SENSORS AND ACTUATORS (THROUGH MODEL YEAR 1986)

Self-Test Input (STI)

The STI is an ECA input induced by the technician while testing the vehicle. When the STI wire is jumped to the proper self-test terminal, the ECA will begin a series of self-test checks. A more detailed description will be given in the diagnostic operation of this manual.

Throttle Position (TP) Sensor

The TP sensor (Fig. 23) is a rotary potentiometer. It is mounted so that the signal contact moves in proportion to the throttle angle.

Resistance range is zero to 4,000 ohms +/−20% with the sensor disconnected from the wiring harness.

At wide-open throttle (85 degrees), the signal to the ECA is approximately 90% of reference voltage. At closed throttle, the signal is approximately 12% of reference voltage. In between, the signal is proportional.

The TP sensor provides the ECA with a signal proportional to the opening of the throttle plate(s). The sensor output signal uses a reference voltage of 5 volts on EEC-IV vehicles.

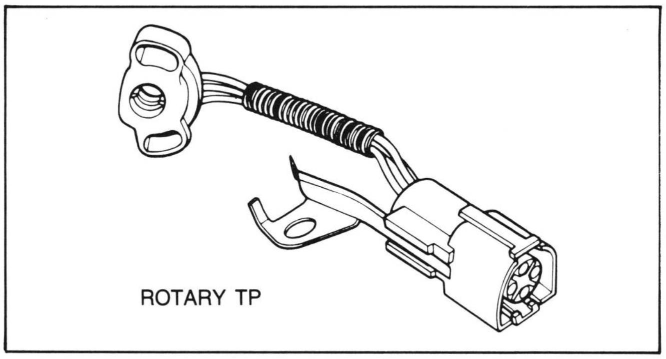

Figure 23. TP Sensor

Transmission Hydraulic Switches 4-3/3-2 (THS 4-3/3-2)

The AXOD transaxle signals to the ECA which gear the transaxle has entered. The THS 4-3 and 3-2 are necessary for ECA control of the locking upshift torque converter (Fig. 24).

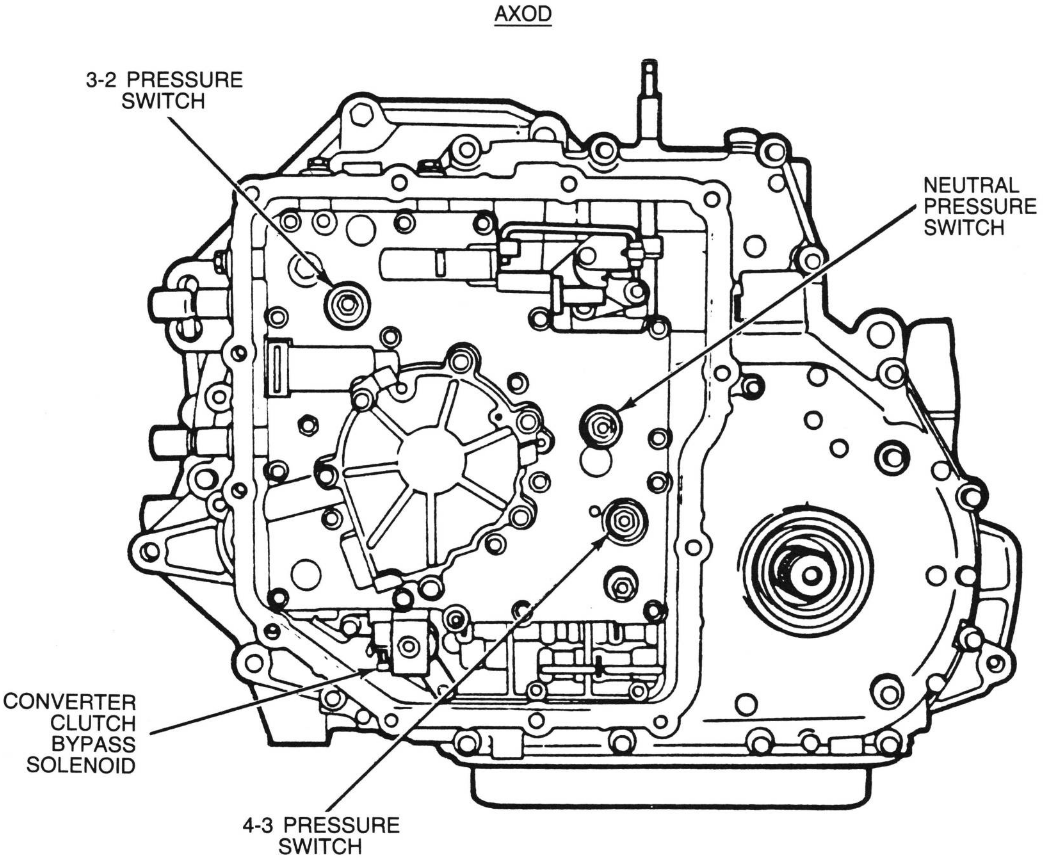

Figure 24. THS 4-3 and 3-2 (AXOD Shown)

ELECTRONIC ENGINE CONTROLS (EEC-IV) SENSORS AND ACTUATORS (THROUGH MODEL YEAR 1986)

Vane Airflow (VAF) Sensor

The vane meter is located behind the air cleaner assembly. Airflow through the body moves the vane mounted on a pivot pin. The more air flowing through the meter, the farther the vane rotates about the pivot points.

The air vane pivot pin is connected to a potentiometer inside the assembly. The output of the VAF sensor to the ECA varies, depending on the volume of air flowing through the housing. A higher volume of air produces a high-voltage output (Fig. 25).

Vane Air Temperature (VAT) Sensor

The VAT sensor is an integral part of the vane meter. (The vane meter also contains the vane airflow sensor and is only used on certain ported fuel injection systems.)

The volume of air through the vane meter must to be converted into an air/mass value. The mass (weight) of a specific volume of air varies with pressure and temperature. To compensate for these variables, a VAT sensor, located in front of the vane meter, measures the incoming air temperature. The sensor is a thermistor which is similar in operation to the thermistor used on the ACT sensor.

The ECA uses air temperature and a pressure signal received from the BP sensor to convert the signal from the vane airflow sensor into a mass airflow value. This value is used to calculate the fuel flow necessary for an optimum air/fuel ratio. In other operations, the VAT sensor is similar to the ACT sensor used on non-ported fuel injection systems (Fig. 26).

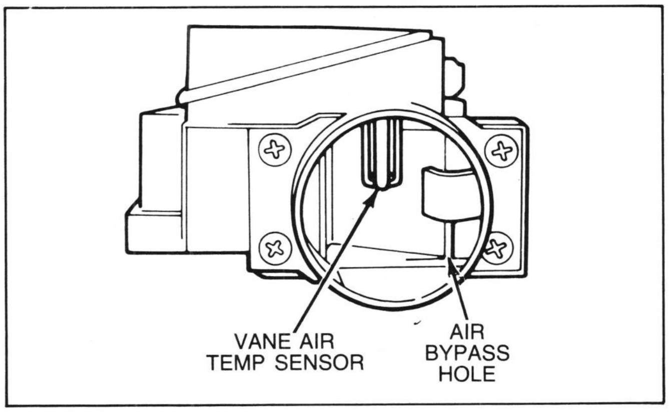

Figure 26. Vane Air Temperature (VAT) Sensor

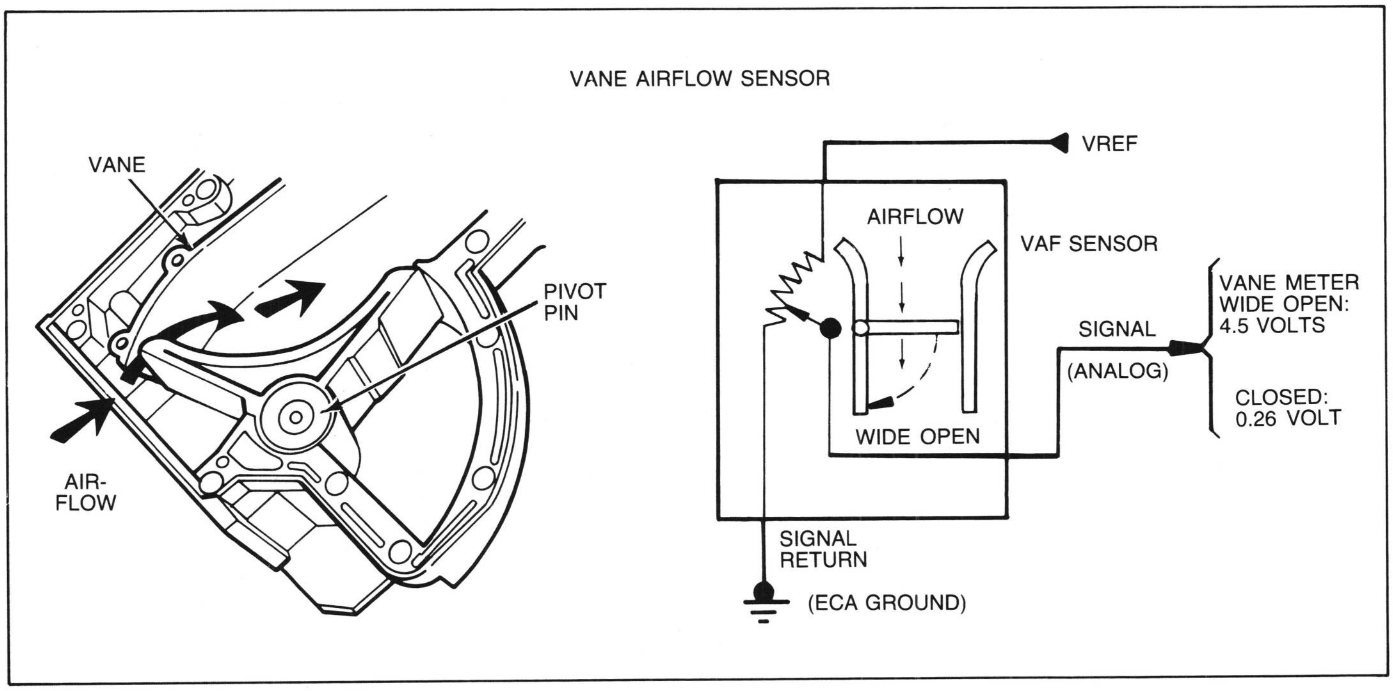

Figure 25. Vane Airflow (VAF) Meter

ELECTRONIC ENGINE CONTROLS (EEC-IV) SENSORS AND ACTUATORS (THROUGH MODEL YEAR 1986)

Vehicle Speed Sensor (VSS)

The VSS, used on some models, is a magnetic induction device. It is driven by the transmission and operates at road speed. The ECA uses this input to determine proper torque converter lockup and speed control operation (Fig. 27).

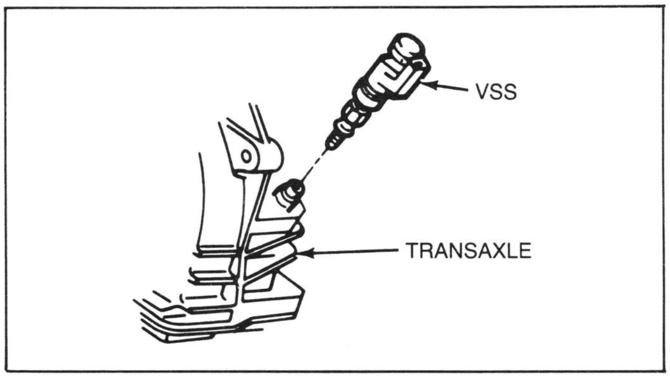

Figure 27. Vehicle Speed Sensor (VSS)

INPUT SUMMARY

All of these inputs supply some type of information which is evaluated by the ECA to determine the proper operating sequence. The inputs are tested differently. Refer to the appropriate testing sequence before **ANY** EEC-IV vehicle evaluation.

OUTPUT COMPONENT DESCRIPTION

As previously discussed, the ECA monitors engine operating conditions and determines the proper operation of the engine controls. These controls are executed in the form of ECA outputs. These outputs are command functions of the ECA and are used to control the engine operating system. Output controls are divided into four categories:

- Electrical solenoids
- Electric motors
- Controller modules
- Other outputs

Electrical Solenoids

Electrical solenoids are electromechanical devices that control the operation of an engine function. The most common type of solenoid controls vacuum to various diaphragms (such as the EGR valve). These valves are normally closed. These solenoids include:

- Boost control solenoid
- Canister purge (CANP) solenoid
- Converter clutch override (CCO) solenoid
- Exhaust gas recirculation (EGR) shutoff solenoid
- Exhaust gas recirculation control (EGRC) solenoid
- Exhaust gas recirculation vent (EGRV) solenoid
- Exhaust heat control (EHC) solenoid valve
- EGR vacuum regulator (EVR)
- Feedback control (FBC)
- Inlet air solenoid (IAS)
- Injectors
- Integrated vehicle speed outputs
- Locking upshift solenoid (LUS) (AXOD only)
- Thermactor air bypass (TAB)
- Thermactor air diverter (TAD)
- Temperature-compensated accelerator pump (TCP)
- Throttle air bypass valve
- Vehicle speed control solenoids

Electric Motors

An electric motor on the EEC-IV system is a device that rotates when an electric current is passed through it. Electric motors are another form of ECA-controlled output and are generally used to position a component or pump a fluid. The electric motors may be controlled by another relay that is ECA-controlled. ECA-controlled electric motors include:

ELECTRONIC ENGINE CONTROLS (EEC-IV) SENSORS AND ACTUATORS (THROUGH MODEL YEAR 1986)

- Electro-drive fan (EDF)
- High electro-drive fan (HEDF)
- DC motor idle speed control (ISC)
- Electric fuel pump

Controller Modules

A controller module is classified as an electronic relay with no moving parts. A good example is the WOT A/C cutout relay (WAC). The primary function of the assembly is operation of the air conditioning system, when demanded by the driver at the climate control switches. The ECA does not disturb the system until a wide-open throttle signal is obtained by another input. At this time the ECA cancels A/C operation for improved engine performance. The following is a list of controller modules:

- WOT A/C cutout relay (WAC)
- Integrated controller module (ICM)

Other ECA Outputs

The EEC-IV system uses other forms of outputs that do not fall into the categories described. These outputs differ in that they are generally information outputs, sent to an outside system, or they are a control function of the ECA. These systems include:

- Data output link
- Fuel pump relay
- Spark output (SPOUT)
- Self-test output/shift indicator lamp (STO/SIL)
- Variable voltage choke (VVC)

EEC-IV OUTPUTS

All of these outputs are controlled by an electrical signal from the ECA. Not all of them, however, are used on any one vehicle application. The following EEC-IV system outputs are listed in alphabetical order.

Boost Control Solenoid

On certain engine applications the ECA uses a solenoid to control boost pressure to the turbocharger wastegate (Fig. 28). This normally closed solenoid, when energized by the ECA, allows boost pressure from the turbocharger compressor outlet to bleed through the solenoid and back into the turbocharger compressor.

Without the boost control solenoid, the wastegate would open at approximately 69 kPa (10 psi). When the ECA energizes the solenoid, boost pressure into the engine can increase up to approximately 103 kPa (15 psi). The solenoid will open and close at 40 Hz (40 cycles per second). The amount of boost depends on engine requirements, as calibrated to the ECA.

Canister Purge (CANP) Solenoid

The CANP solenoid (Fig. 29) is a normally closed solenoid, mounted in line between the carbon canister and the intake manifold. When the ECA energizes the solenoid, it opens, allowing intake manifold vacuum to draw the fuel vapors from the canister for combustion in the engine. When the ECA de-energizes the solenoid, fuel vapors are stored in the carbon canister.

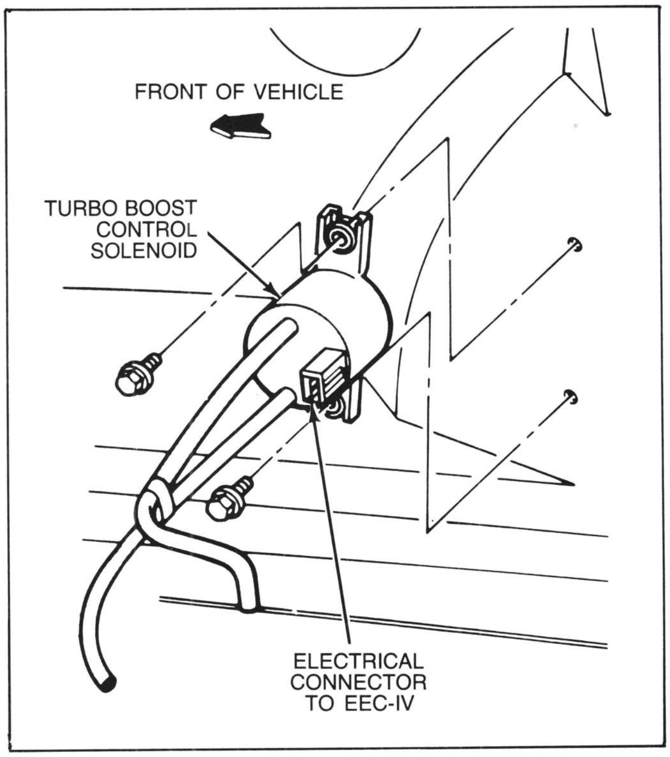

Figure 28. Boost Control Solenoid

Converter Clutch Override (CCO) Solenoid

The CCO solenoid (Fig. 30) is used on vehicles equipped with a A4LD automatic transmission. The ECA energizes the solenoid when certain engine and vehicle speed requirements have been met. When the solenoid is energized, transmission fluid

ELECTRONIC ENGINE CONTROLS (EEC-IV) SENSORS AND ACTUATORS (THROUGH MODEL YEAR 1986)

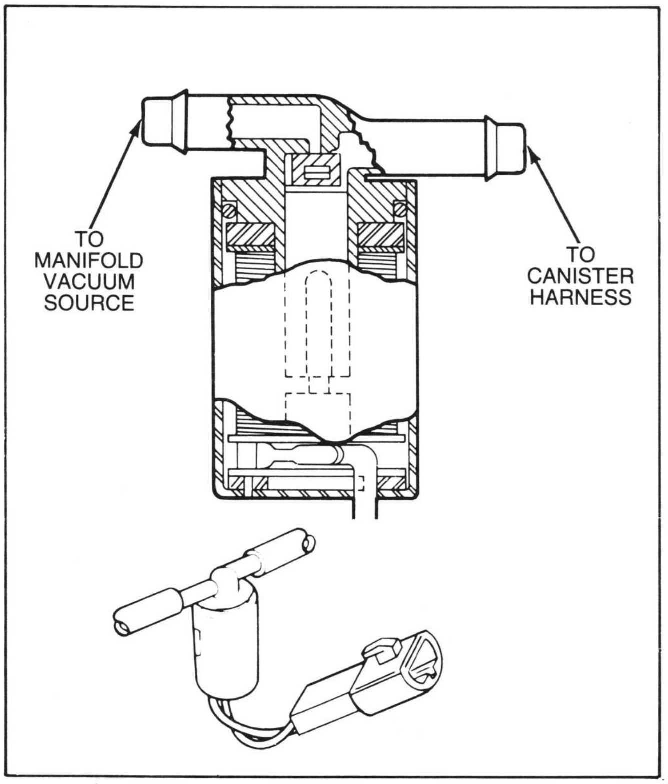

Figure 29. Canister Purge (CANP) Solenoid

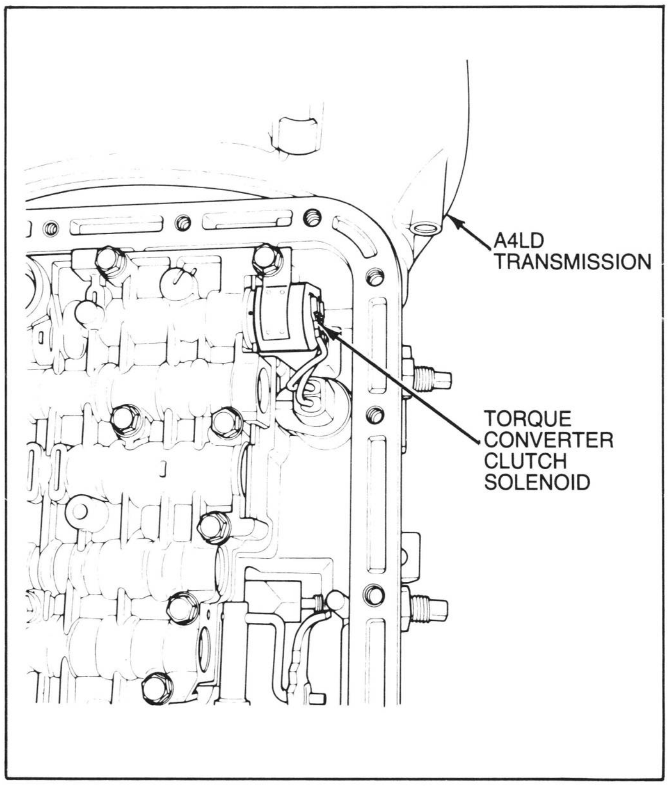

Figure 30. Converter Clutch Override (CCO) Solenoid

flows into passages in the torque converter, allowing the torque converter to lock up. This enables a direct connection between the engine and the transmission (when operating in third or fourth gears), similar to a direct connection made possible in a manual transmission.

Before energizing the solenoid, the ECA requires an engine at operating temperature, low-engine load, part-throttle cruise, and correct engine RPM. When the stoplamp (BOO sensor) switch is closed, the ECA de-energizes the CCO solenoid. The solenoid is also de-energized from the TP sensor during WOT.

Data Output Link

The data output link terminal is an electrical communication link to the electronic instrument cluster. This output is simply a source of information used by the cluster for tripminder functions.

EGR Shutoff Solenoid and EGR On/Off Solenoid

Certain systems control EGR flow using a single solenoid (Fig. 31): either the EGR shutoff solenoid or the EGR on/off solenoid (depending on engine application). When these normally closed solenoids are energized by the ECA, a vacuum signal flows to the EGR valve. When the ECA de-energizes the solenoids, the vacuum signal is blocked and the EGR valve closes.

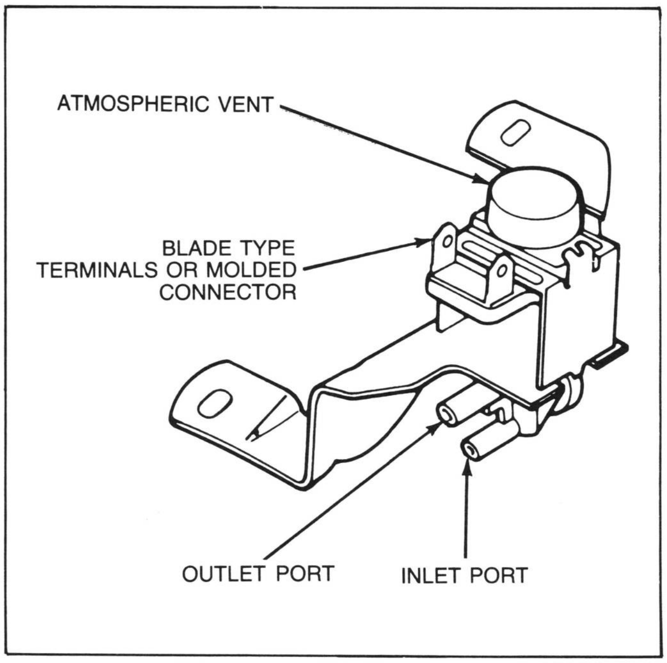

Figure 31. EGR ON/OFF Solenoid

ELECTRONIC ENGINE CONTROLS (EEC-IV) SENSORS AND ACTUATORS (THROUGH MODEL YEAR 1986)

EGR Vacuum Regulator (EVR) Solenoid

An EVR solenoid (Fig. 32) is used on certain engine applications. This regulator operates similar to a normally closed EGR on/off solenoid and is used to control the vacuum signal to the EGR valve. The main difference is the regulator solenoid's ability to bleed off the vacuum in the EGR system. This single valve can replace both the EGRC and EGRV solenoids, and can provide regulated vacuum to precisely control EGR operation.

Electro-Drive Fan (EDF) and High Electro-Drive Fan (HEDF)

On some applications, an integrated controller module (ICM) houses the control relays of the EEC-IV system (Fig. 33). The ECA controls these functions through the use of output signals. When the ECA determines that high- or low-fan speed is necessary, pins 52 or 55 are grounded. The ECA can control other functions as well through the ICM. These are:

- Fuel pump
- WAC

The EEC power relay is also housed in the ICM (Fig. 34).

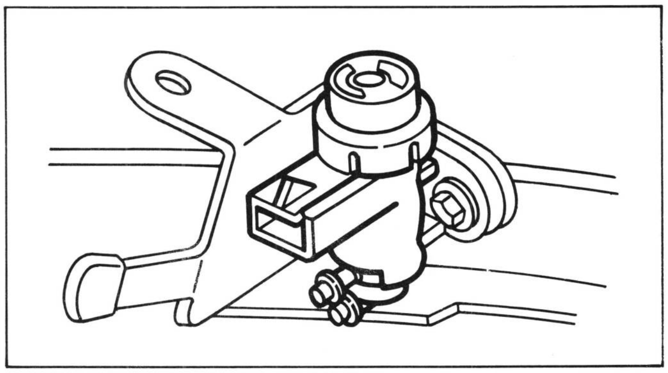

Figure 32. EVR Solenoid

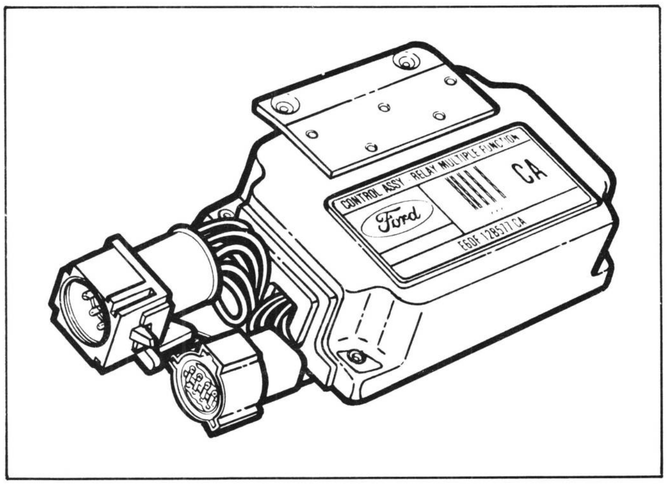

Figure 33. Integrated Controller Module (ICM)

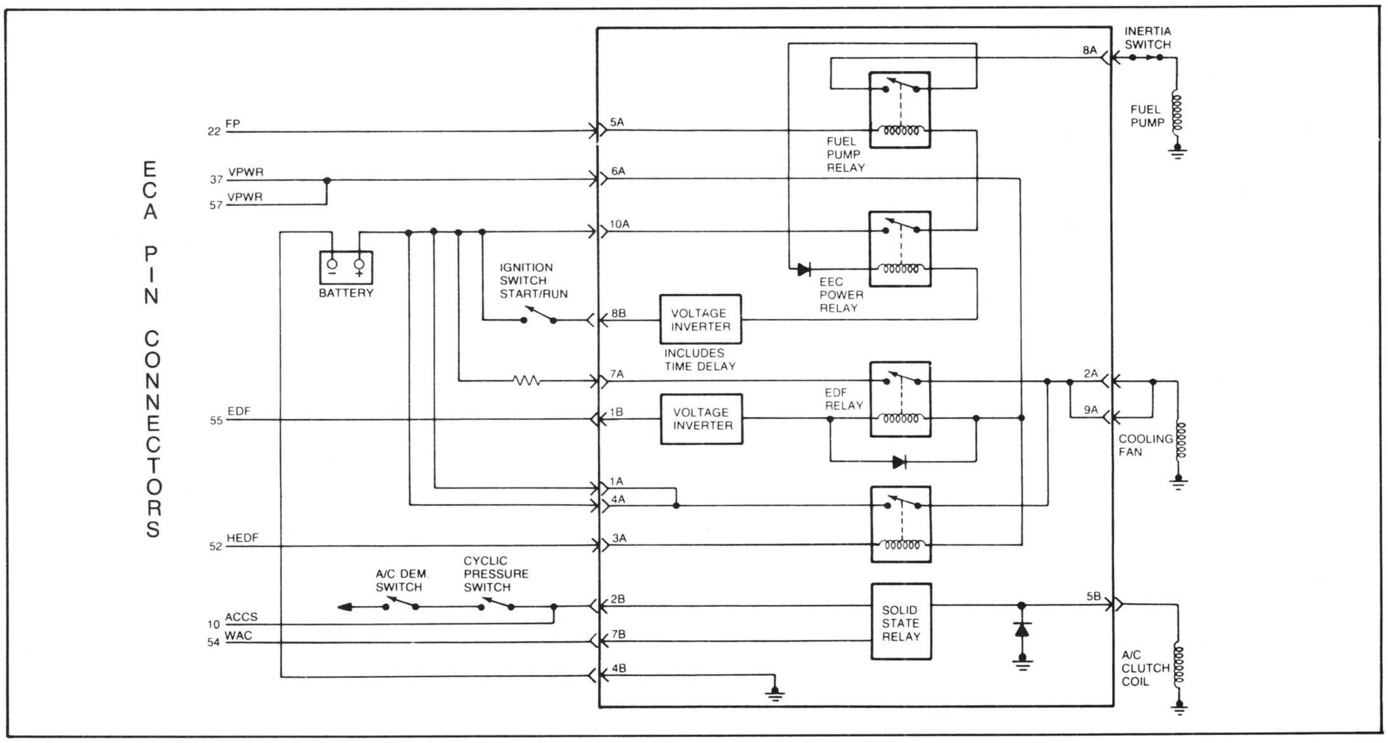

Figure 34. ICM Schematic

ELECTRONIC ENGINE CONTROLS (EEC-IV) SENSORS AND ACTUATORS (THROUGH MODEL YEAR 1986)

Exhaust Gas Recirculation Control and Vent Solenoids (EGRC/EGRV)

On certain EEC applications, the ECA uses two solenoids, one normally closed (EGRC) and one normally open (EGRV), to control the flow of EGR gases through the EGR valve (Fig. 35).

The EGRC solenoid controls the vacuum signal to the EGR valve. When the solenoid is **not** energized, the vacuum signal applied to the solenoid from the engine **cannot** flow through the solenoids. When the solenoid is energized by the ECA, the vacuum signal passes through to the EGR valve.

The EGRV solenoid vents the vacuum control line to the EGR valve. When the solenoid is **not** energized, it is open. This allows the vacuum signal to the EGR valve, from the EGRC solenoid, to be vented to the atmosphere. When the solenoid is energized by the ECA, the solenoid is closed and the vacuum signal is not vented to the atmosphere.

The ECA uses both of these solenoids to control EGR flow. In normal operation, during warm-engine cruise, the EGRC and EGRV solenoids are "dithering" on/off to maintain the proper EGR valve position (Fig. 36).

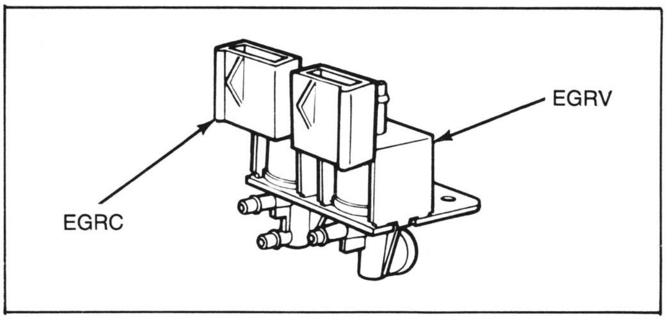

Figure 35. EGRC/EGRV Solenoids

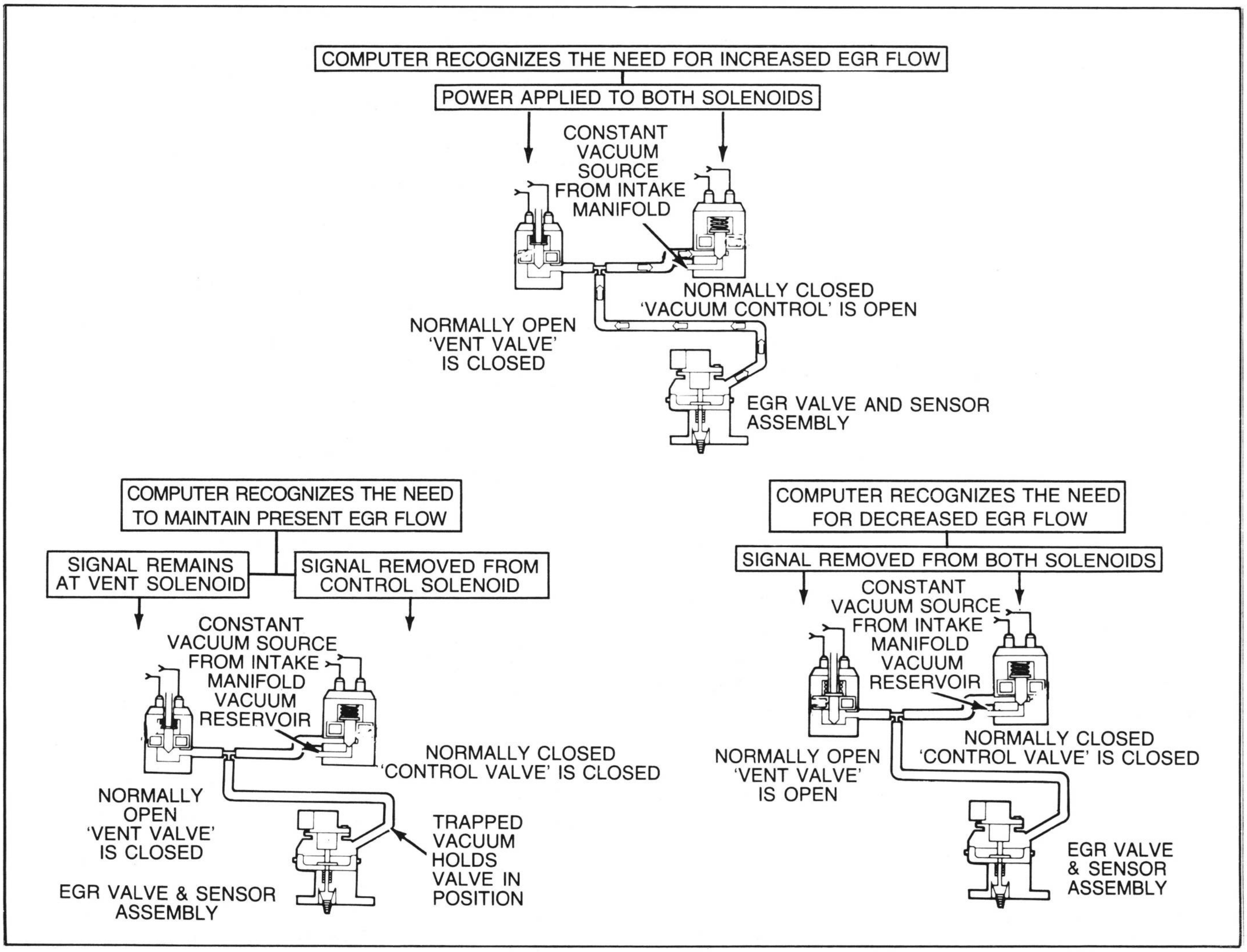
COMPUTER RECOGNIZES THE NEED FOR INCREASED EGR FLOW
POWER APPLIED TO BOTH SOLENOIDS
CONSTANT VACUUM SOURCE FROM INTAKE MANIFOLD
NORMALLY CLOSED 'VACUUM CONTROL' IS OPEN
NORMALLY OPEN 'VENT VALVE' IS CLOSED
EGR VALVE AND SENSOR ASSEMBLY
COMPUTER RECOGNIZES THE NEED TO MAINTAIN PRESENT EGR FLOW
SIGNAL REMAINS AT VENT SOLENOID
SIGNAL REMOVED FROM CONTROL SOLENOID
CONSTANT VACUUM SOURCE FROM INTAKE MANIFOLD VACUUM RESERVOIR
NORMALLY CLOSED 'CONTROL VALVE' IS CLOSED
NORMALLY OPEN 'VENT VALVE' IS CLOSED
TRAPPED VACUUM HOLDS VALVE IN POSITION
EGR VALVE & SENSOR ASSEMBLY
COMPUTER RECOGNIZES THE NEED FOR DECREASED EGR FLOW
SIGNAL REMOVED FROM BOTH SOLENOIDS
CONSTANT VACUUM SOURCE FROM INTAKE MANIFOLD VACUUM RESERVOIR
NORMALLY CLOSED 'CONTROL VALVE' IS CLOSED
NORMALLY OPEN 'VENT VALVE' IS OPEN
EGR VALVE & SENSOR ASSEMBLY

Figure 36. EGR Operating Modes

ELECTRONIC ENGINE CONTROLS (EEC-IV) SENSORS AND ACTUATORS (THROUGH MODEL YEAR 1986)

Exhaust Heat Control (EHC) Solenoid

Some applications incorporate a heat crossover system that improves cold driveability by directing exhaust gases to a pad under the intake manifold. By warming this pad, better air/fuel vaporization is obtained. When the engine is at operating temperature, heating the pad is not necessary. The ECA activates an electromechanical solenoid to induce heated crossover operation (Fig. 37).

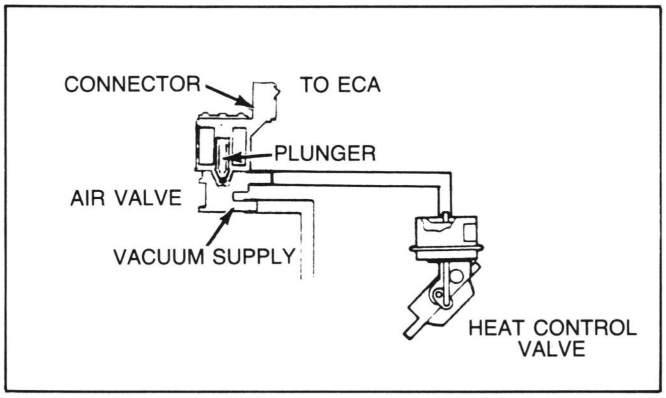

Figure 37. EHC Operation

Feedback Control (FBC) Solenoid

Two types of feedback solenoids are used on EEC-IV applications: the feedback control solenoid and the remote-mounted duty cycle solenoid.

The feedback control solenoid is a pulsing solenoid that introduces fresh air from the air cleaner into the idle and main system vacuum passages. An electrical signal from the ECA activates the solenoid. The amount of air allowed to enter depends on the solenoid's duty cycle. A zero percent duty cycle closes the solenoid (no voltage), and the carburetor will go to a maximum rich condition. A 100% duty cycle (voltage applied) fully opens the solenoid, and the carburetor will go to a maximum lean condition. The two feedback solenoids look different and mount differently on the carburetors, but they operate in the same manner. The remote-mounted duty cycle solenoid regulates idle, off idle, and main system air/fuel ratios.

A separate channel in the air horn of the carburetor conveys the idle feedback-regulated bleed air into the idle fuel mixture. This channel has an external port connected to the duty cycle solenoid by a rubber hose. The air channel intersects the idle channel at the same point as the fixed idle air bleed. As the amount of air bleed into the system increases, the air/fuel ratio becomes leaner. Thus, the duty cycle solenoid regulates the idle air/fuel ratio.

For main system control, the duty cycle solenoid regulates a vacuum to a fuel control valve assembly. The valve assembly consists of a diaphragm and actuator in the air horn and a metering valve (needle and seat) in the main body. The regulated vacuum above the diaphragm moves the actuator which, in turn, positions a tapered needle in the valve seat, allowing additional fuel to flow through the feedback channel restrictor into the main well. This regulates the fuel flow into the main system, thus controlling the off idle and part-throttle air/fuel ratios.

When the ECA recognizes the need for a leaner air/fuel ratio, it signals the duty cycle solenoid to supply higher vacuum, which moves the diaphragm and actuator upward. The spring below the tapered needle forces it upward to decrease fuel flow past the needle. Conversely, when the ECA signals the duty cycle solenoid to lower vacuum, the spring above the actuator moves it and the tapered needle downward, allowing more fuel to flow past the needle.

The FBC solenoids are shown in Figure 38.

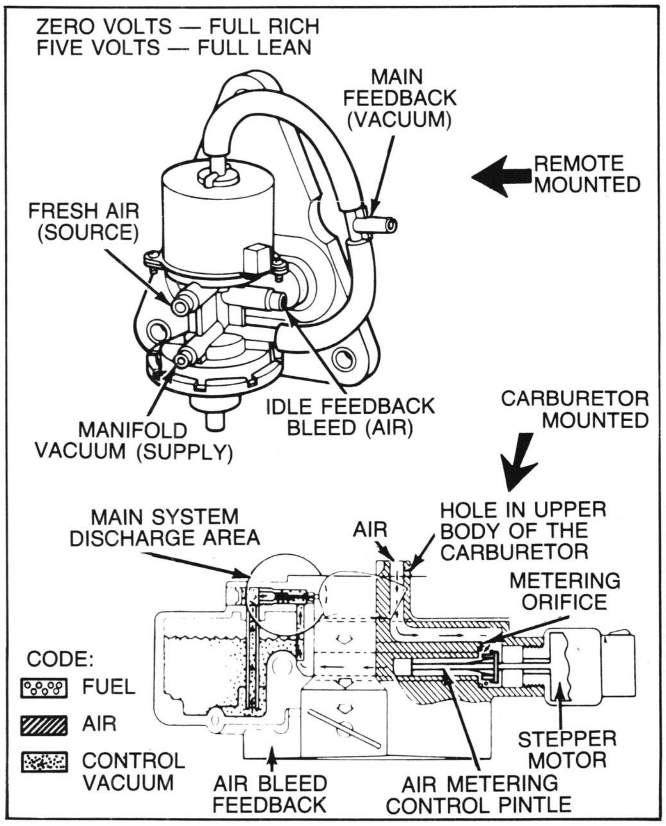

Figure 38. FBC and Remote-Mounted Duty Cycle Solenoids

ELECTRONIC ENGINE CONTROLS (EEC-IV) SENSORS AND ACTUATORS (THROUGH MODEL YEAR 1986)

Fuel Pump Relay

The fuel pump relay is normally open, supplying the electric fuel pump(s) with battery voltage. When the EEC power relay is activated, battery voltage is supplied to the fuel pump relay. The ECA supplies a ground to the relay to activate the fuel pump(s) (Fig. 39).

Inlet Air Solenoid (IAS)

The IAS is used on the 2.8L V-6 Ranger/Bronco II engine. It is a normally closed solenoid which controls the vacuum signal to the air cleaner vacuum door motor. When the ECA energizes the solenoid, a vacuum signal flows to the vacuum door motor, allowing the door to close to cold ambient air. The air entering the air cleaner is then heated through a heat stove located on the exhaust manifold. When the solenoid is de-energized, the vacuum signal is stopped and the door opens to unheated air. This solenoid allows the ECA to control the vacuum motor door that had previously been controlled by an air cleaner bimetal and vacuum retard delay valve.

Fuel Injector Solenoid — High Pressure

Fuel injectors (Fig. 40) are normally closed electromechanical devices which meter and atomize the fuel delivered to the engine. When the ECA energizes the fuel injectors, fuel flows through the body and out of the end of the injector. The energizing of the solenoid is commonly referred to as injector "pulse width" or "on" time. Since the injector flow orifice is fixed, and the fuel supply is regulated, fuel flow to the engine is primarily controlled by the amount of time the solenoid is energized. The fuel injector solenoids are mounted in a throttle body or in the intake manifold, depending on the type of system used.

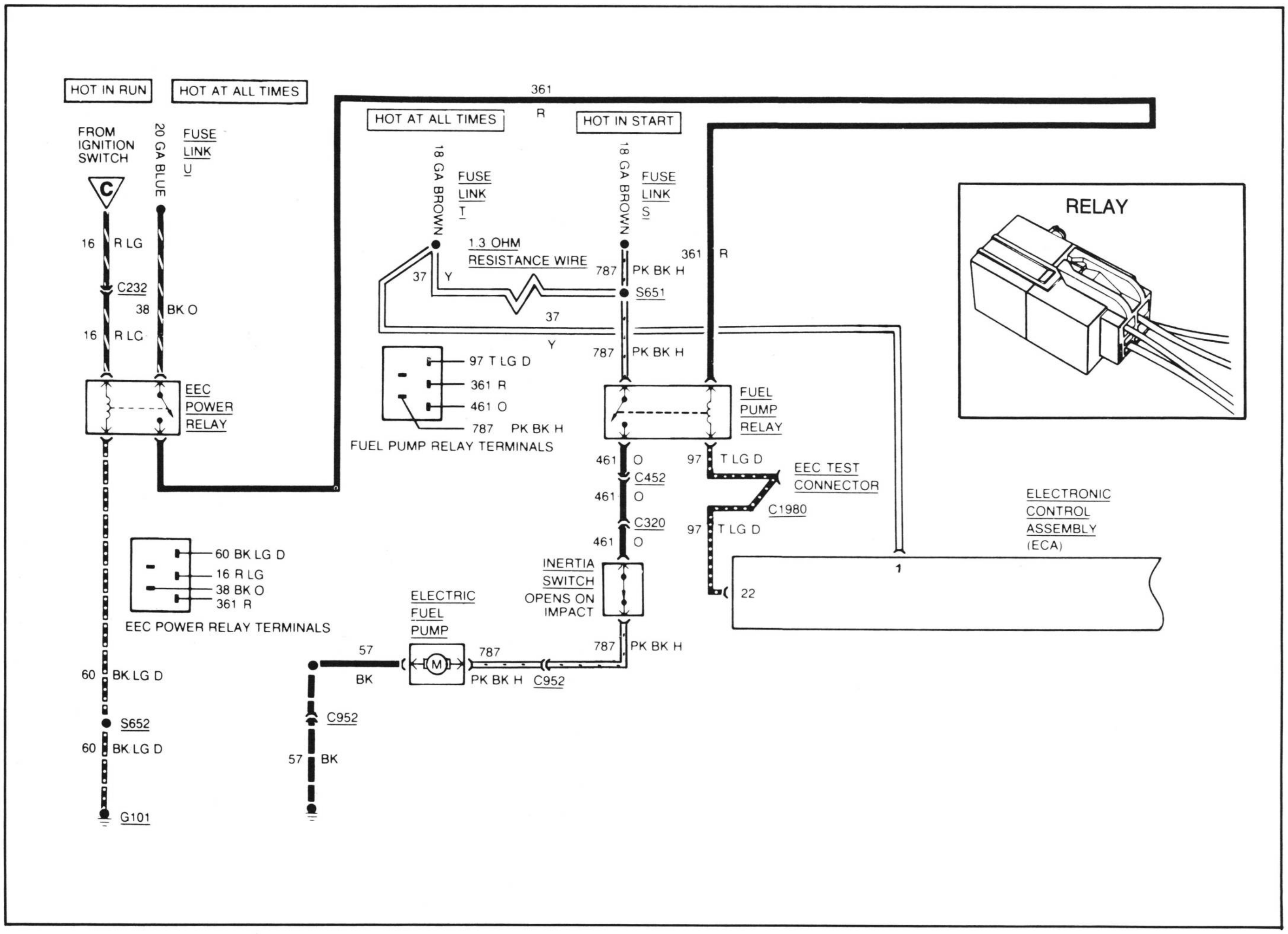

Figure 39. Fuel Pump Relay Schematic

ELECTRONIC ENGINE CONTROLS (EEC-IV) SENSORS AND ACTUATORS (THROUGH MODEL YEAR 1986)

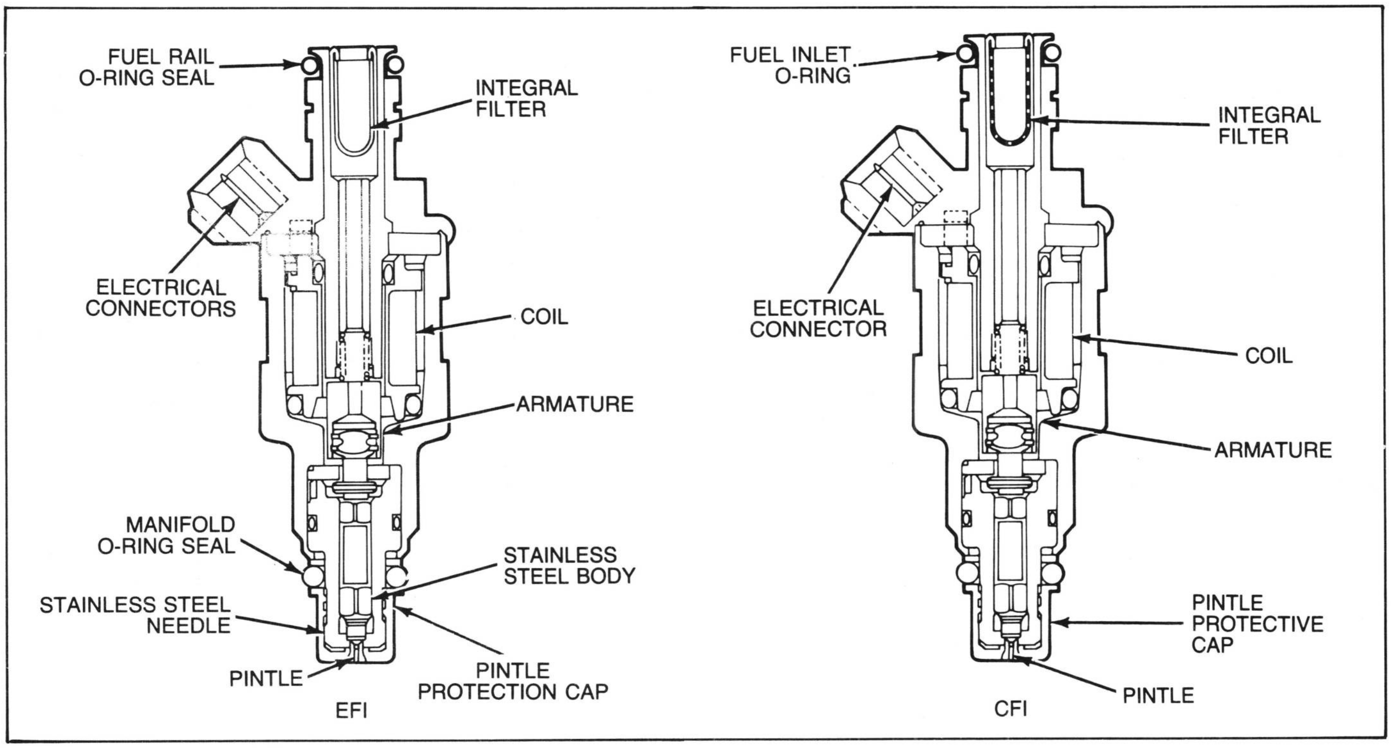

Figure 40. High- and Low-Pressure Fuel Injectors

Fuel Injector Solenoid — Low Pressure

The low-pressure fuel injector solenoid (Fig. 41) is used on the low-pressure central fuel injection system. (It is also a normally closed electromechanical device.) When this injector is energized, a ball is moved off its seat. This allows the fuel to flow from the spray nozzle through six metered orifices.

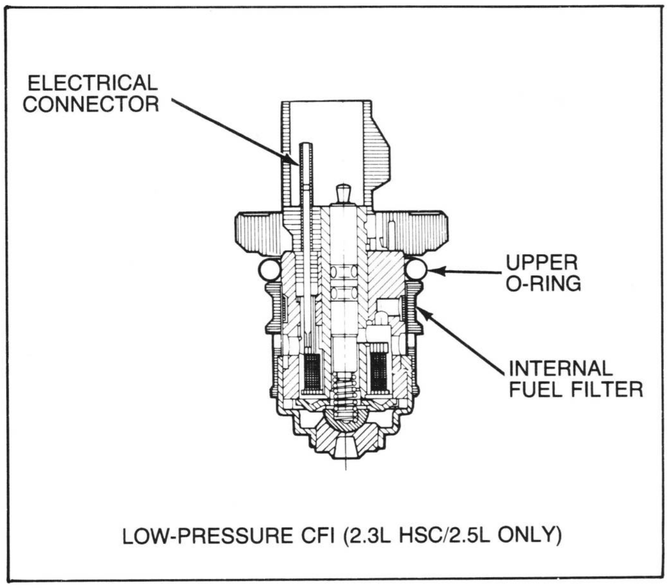

Figure 41. Low-Pressure Fuel Injector Solenoid

DC Motor Idle Speed Control (ISC)

The DC motor ISC (Fig. 42) is used by the ECA to control:

- Cold and warm engine idle speed
- Anti-diesel operation
- Dashpot functions

On a cold engine start-up, the ISC plunger is extended to its farthest position. As the engine warms up, the plunger is retracted by the ECA. If the A/C compressor is turned on, the ECA will extend the plunger a certain distance to increase engine idle speed to compensate for the added load. When the throttle is opened and the lever leaves contact with the plunger, a switch (idle tracking switch) in the end of the plunger signals the ECA. The ECA will then fully extend the plunger where, upon contact with the lever (during deceleration), it will act as a dashpot, slowing the return of the throttle lever. When the engine is shut down, the plunger will retract, preventing the engine from dieseling. Then, it will extend for the next engine start-up.

ELECTRONIC ENGINE CONTROLS (EEC-IV) SENSORS AND ACTUATORS (THROUGH MODEL YEAR 1986)

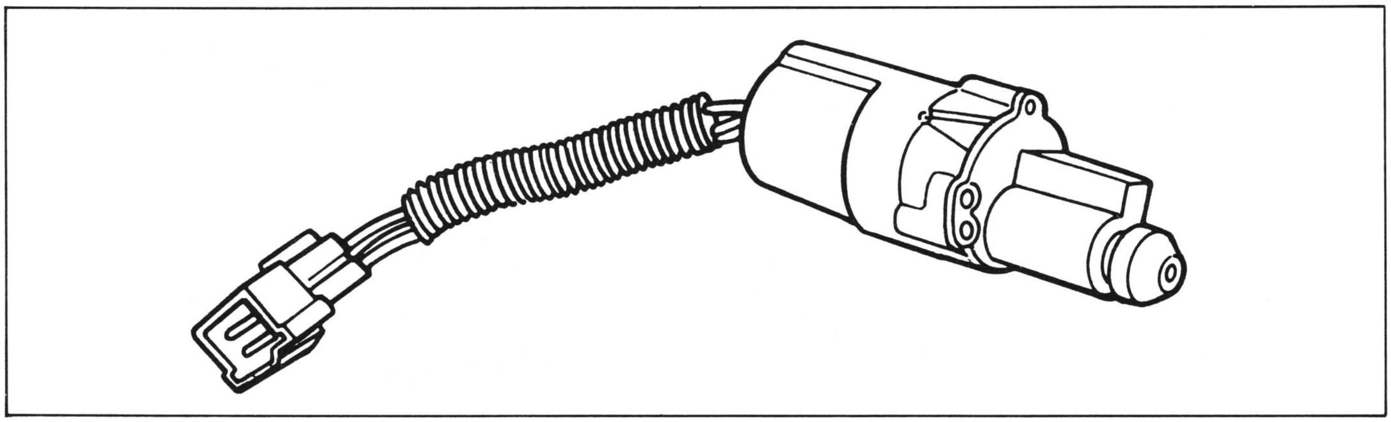

Figure 42. DC Motor Idle Speed Control

Locking Upshift Solenoid (LUS)

The LUS is an electromechanical device mounted to the AXOD transaxle. When energized (grounded) by the ECA, it routes hydraulic pressure to the locking upshift torque converter. The ECA controls this solenoid through input information from the neutral drive switch, the THS 4-3, and the THS 3-2, also located in the valve body (Fig. 43).

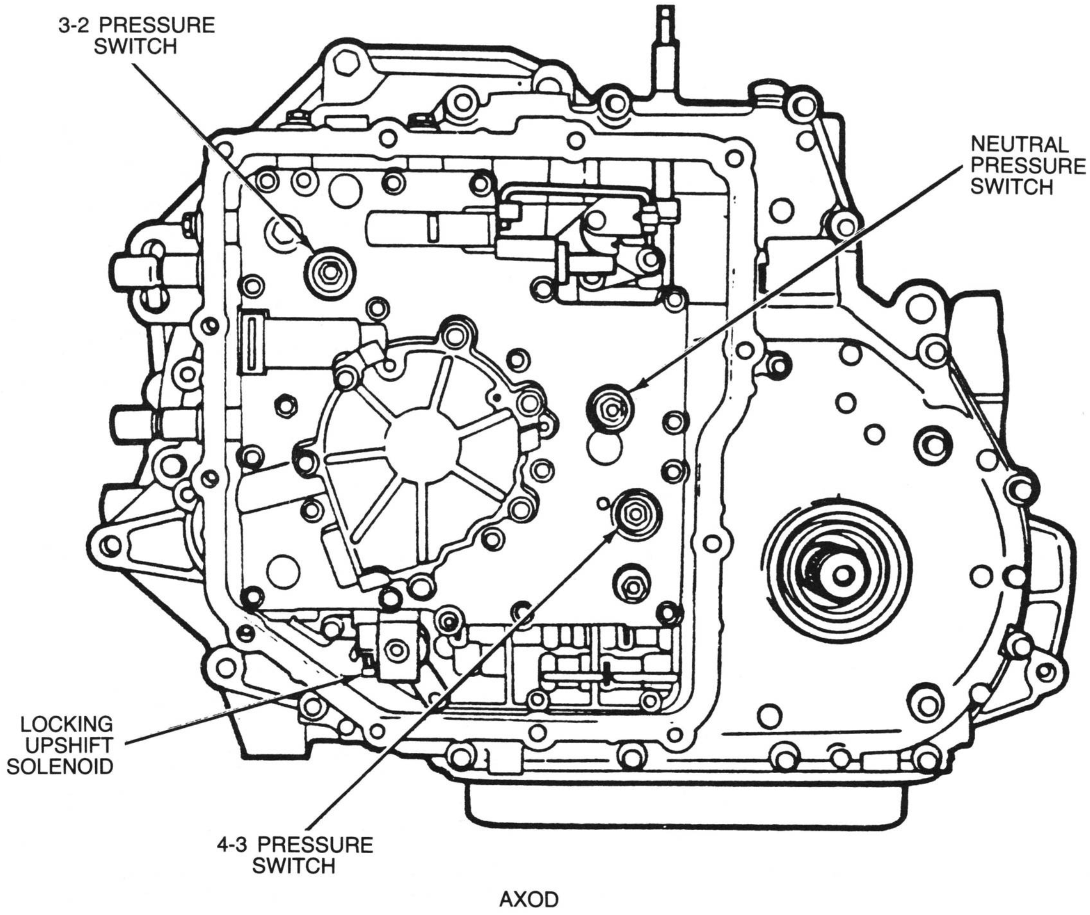

Figure 43. Locking Upshift Solenoid

ELECTRONIC ENGINE CONTROLS (EEC-IV) SENSORS AND ACTUATORS (THROUGH MODEL YEAR 1986)

Spark Output (SPOUT)

Since the distributor has no vacuum or centrifugal advance, the ECA must control the timing of the engine during different operating conditions.The ECA signals spark timing by way of the spark output (SPOUT) circuit.

NOTE: When setting base timing on the vehicle, it is necessary to disconnect the spout circuit. Failure to do so will result in inaccurate base timing. Refer to the Emission Information decal located in the engine compartment.

Self-Test Output (STO)

On EEC-IV vehicles, an STO connector is used to diagnose the EEC system. By using a STAR tester (or voltmeter) it is possible to read the STO codes. When a code is obtained, refer to the Engine/Emission Diagnosis Manual, Volume H.

Thermactor Air Bypass/Diverter (TAB/TAD) Solenoids

On EEC-IV vehicles equipped with Thermactor air, the ECA uses two normally closed solenoids (Fig. 44) to control Thermactor airflow to the engine or the exhaust manifold, or to the catalytic converter.

The TAB solenoid controls a vacuum signal to the air bypass valve, or to the air bypass valve side of a combination air control valve. On most applications, when this valve is **not** energized, Thermactor air will be diverted to the air control valve (or air control valve side of the combination valve), where the TAD will direct Thermactor airflow.

The TAD solenoid is used to divert Thermactor air either upstream (to the engine or the exhaust manifold) or downstream (to the catalytic converter). On most applications, when the solenoid is **not** energized, Thermactor airflow is diverted upstream.

Temperature-Compensated Accelerator Pump (TCP) Solenoid

The TCP solenoid is used on the 2.8L V-6 engine. The TCP solenoid is normally closed and controls a vacuum signal to the accelerator pump in the 2150A-2V carburetor. When the engine is cold the solenoid will **not** be energized. This allows the accelerator pump to admit a larger shot of fuel in the accelerator pump circuit for improved cold engine driveability. After the engine has reached a predetermined temperature the ECA will energize the TCP solenoid, allowing a vacuum signal to flow to the accelerator pump. With vacuum applied to the accelerator pump, a smaller shot of fuel will be admitted into the carburetor. On a warm engine, less fuel is needed for acceleration (Fig. 45).

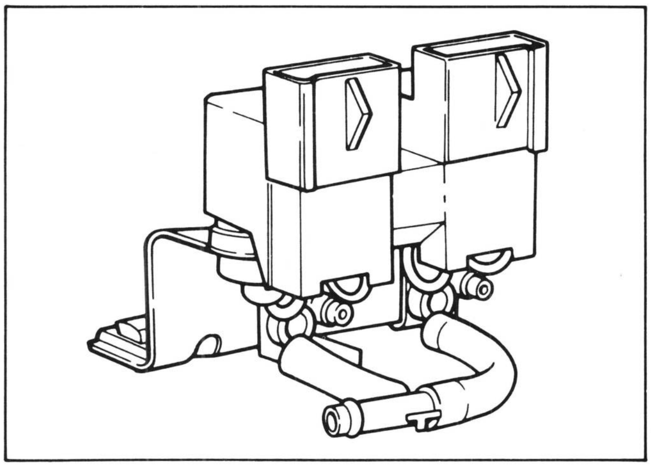

Figure 44. TAB/TAD Solenoids

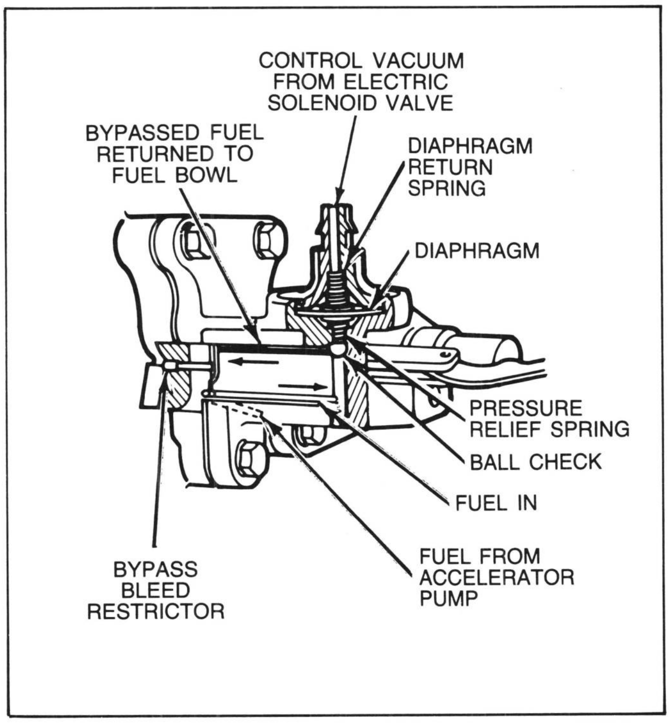
CONTROL VACUUM FROM ELECTRIC SOLENOID VALVE
BYPASSED FUEL RETURNED TO FUEL BOWL
DIAPHRAGM RETURN SPRING
DIAPHRAGM
PRESSURE RELIEF SPRING
BALL CHECK
FUEL IN
FUEL FROM ACCELERATOR PUMP
BYPASS BLEED RESTRICTOR

Figure 45. 2150A-2V TCP Operation

Throttle Air Bypass Valve

The throttle air bypass valve (Fig. 46) is operated by the ECA to control engine idle speed on vehicles equipped with multi-point electronic fuel injection. The solenoid allows air to bypass the throttle plate(s) according to commands from the ECA. During cold engine start-up, the ECA will go to a 100%

ELECTRONIC ENGINE CONTROLS (EEC-IV) SENSORS AND ACTUATORS (THROUGH MODEL YEAR 1986)

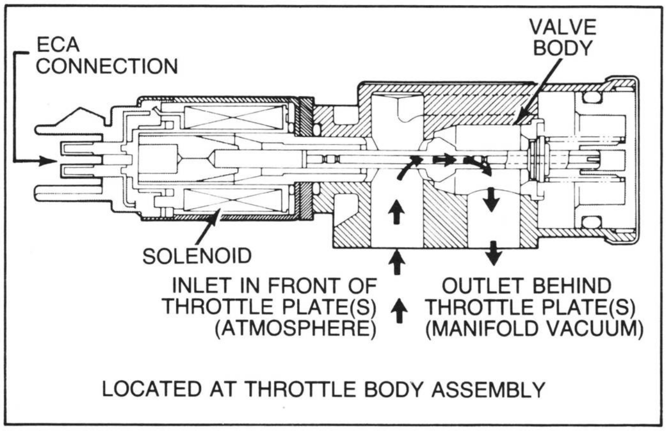
ECA CONNECTION
VALVE BODY
SOLENOID
INLET IN FRONT OF THROTTLE PLATE(S) (ATMOSPHERE)
OUTLET BEHIND THROTTLE PLATE(S) (MANIFOLD VACUUM)
LOCATED AT THROTTLE BODY ASSEMBLY

Figure 46. Throttle Air Bypass Solenoid

duty cycle. This opens the valve completely, allowing intake air to flow from the front of the throttle plate(s), through the valve, then out into the throttle body behind the throttle plate(s). The ECA will also use the solenoid as an electronic dashpot. During deceleration, air will bypass the throttle plate(s), preventing engine stall. For control of cold or warm idle speed the ECA will duty cycle the solenoid to achieve a smooth, calibrated idle.

The throttle air bypass solenoid is incorporated in EFI and low-pressure CFI systems. A diode is installed in parallel with the throttle air bypass valve solenoid. The diode prevents voltage spikes from occurring when the solenoid is deactivated.

Vehicle Speed Control Solenoids

On integral speed control systems the ECA operates speed control functions. Two output solenoids control the speed control servo. One solenoid is vent and the other is control. The ECA monitors certain inputs to control speed control output solenoids (Fig. 47).

Variable Voltage Choke (VVC)

A VVC (Fig. 48), on certain EEC-IV applications, uses the duty cycle of battery voltage, based on the percentage of "on" time, to either slow down or speed up choke action. In doing so, it varies the percentage of time the choke is on. This system includes a single-pill choke cap, a solid-state choke relay, and an input from the ECA.

At low temperatures, the ECA will duty cycle voltage to the choke each 2½ seconds that it is energized. As coolant and air temperature increase, or after the engine has been running for a period of time, the percentage of duty cycle voltage to the choke will increase to 100%. At a 10°C (50°F) start-up, the choke is on approximately 20% of the time. At 27°C (80°F) the choke will have a 100% duty cycle.

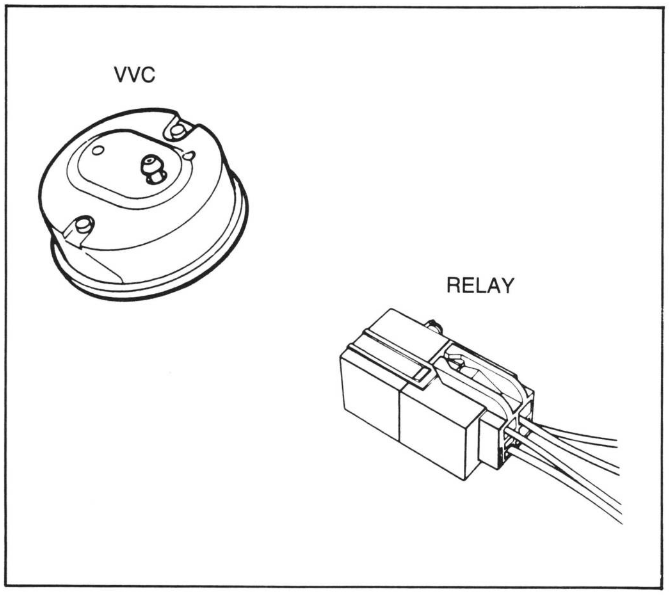

Figure 48. VVC and Relay

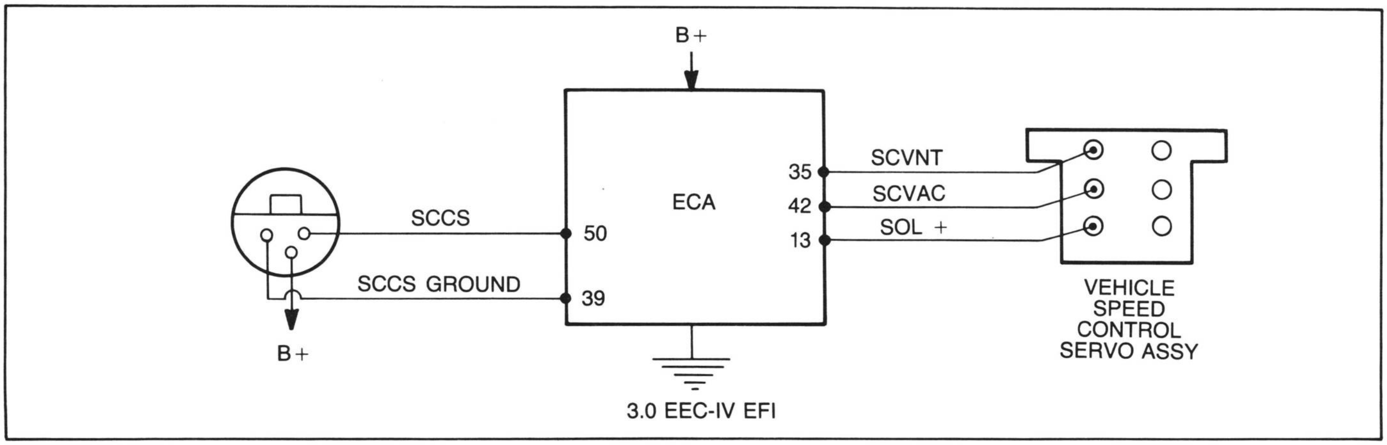

Figure 47. EEC-IV Schematic with Integral Speed Control

ELECTRONIC ENGINE CONTROLS (EEC-IV) SENSORS AND ACTUATORS (THROUGH MODEL YEAR 1986)

WOT A/C Cutout (WAC)

The WAC, on certain EEC-IV engine applications, shuts off the A/C compressor clutch when the engine is in wide-open throttle operation. This feature removes the added load of the A/C compressor from the engine for increased power.

The ECA controls a normally closed relay that is in line with the A/C system. The ECA provides a ground to the relay to cancel A/C operation (Fig. 49).

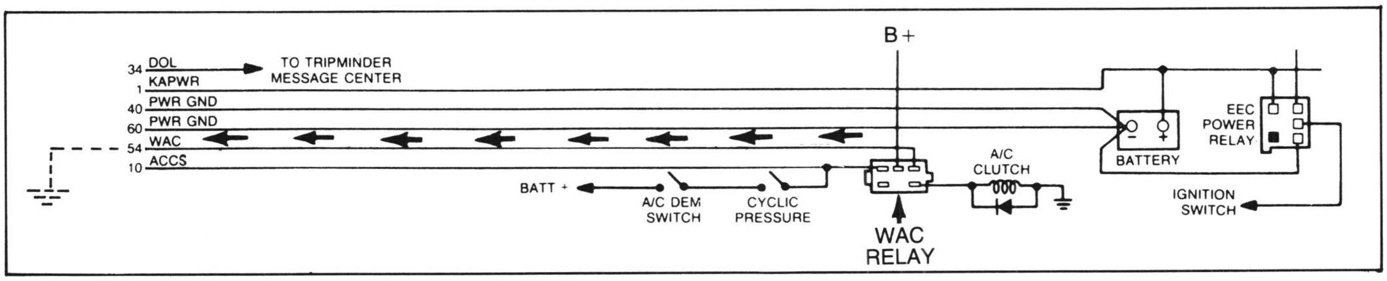

Figure 49. WAC Electrical Schematic

OUTPUT SUMMARY

Not all of the outputs covered in this text are used on any one EEC-IV application. It is the intent of this manual to familiarize the reader with current output components. Refer to the Engine/Emission Diagnosis Manual, Volume H to perform **ANY** diagnosis and testing.

MOTORCRAFT PARTS CROSS REFERENCE

1985

CALIBRATION CODE NUMBER	ENGINE	PART NAME	FORD PART NUMBER	MOTORCRAFT PART NUMBER
All parts listed for this engine are common except those calibrations listed below.	1.6L EFI	ECT Sensor	E1AZ-12A648-A	DY-303
		Baro Sensor	E3ZZ-12A644-A	DY-405
		Dist. Assy.	E3FZ-12127-B	DA-1889
		PIP Assy.	E4PZ-12A112-A	DU-29
		Air Cleaner Vacuum Motor Assy.	E2SZ-9D612-A	CX-682
		Air Cleaner Temp. Sensor	D7FZ-9E607-A	CX-109
		Thermactor Check Valve	E3FZ-9A487-B	CX-772
		EGR Valve	E4FZ-9D475-A	CX-967
4-28A-R0		TP Sensor	E5FZ-9B989-C	CX-1018
4-27A-R02		TP Sensor	E3FZ-9B989-A	CX-855
5-27T-R0		TP Sensor	E5FZ-9B989-B	CX-1011
All parts listed for this engine are common except those calibrations listed below.	2.3L Non Turbo	ECT Sensor	E1AZ-12A648-A	DY-303
		Dist. Modulator Valve	E4ZZ-12A170-B	DY-454
		Dist. Assy.	E59Z-12127-C	DA-1984
		Air Cleaner Temp. Sensor Override	D7ZZ-9E862-A	CX-150
		Air Cleaner Vacuum Motor Assy.	E3FZ-9D612-A	CX-898
		Air Cleaner Temp. Sensor	D7FZ-9E607-A	CX-109
		Thermactor Check Valve (w/Flare Ends)	E5ZZ-9A487-A	CX-985
		Thermactor Check Valve (w/o Flare Ends)	D9AZ-9A487-C	CX-385
		Thermactor Pump	E3ZZ-9A486-A	CX-775
		MAP Sensor	E43Z-9F479-B	DY-430-A
		EGR Valve	E4DZ-9D475-A	CX-950
5-05A-R0		Thermactor Control Valve	E43Z-9F491-C	CX-921
5-06A-R0		Thermactor Control Valve	E4SZ-9F491-A	CX-935
All parts listed for this engine are common except those calibrations listed in left column, top of next page.	2.3L EFI Turbo	ECT Sensor	E1AZ-12A648-A	DY-303
		Baro Sensor	E3ZZ-12A644-A	DY-405
		Dist. Assy.	E59Z-12127-C	DA-1984
		EGR Valve	E4DZ-9D475-A	CX-950

CALIBRATION CODE NUMBER	ENGINE	PART NAME	FORD PART NUMBER	MOTORCRAFT PART NUMBER
5-05D-R0	2.3L EFI Turbo (Cont'd.)	TP Sensor	E4ZZ-9B989-B	CX-503-A
5-05S-R01 &		TP Sensor	E5ZZ-9B989-C	CX-1019
5-05E-R0		Injector Assy.	E5ZZ-9F593-A	CM-4351
5-05R-R10		TP Sensor	E5ZZ-9B989-C	CX-1019
		EGR Valve	E5RY-9D475-B	CX-987
		Injector Assy.	E5ZZ-9F593-A	CM-4351
5-06E-R0		TP Sensor	E5ZZ-9B989-C	CX-1019
5-06E-R10		EGR Valve	E5RY-9D475-B	CX-987
All parts listed for this engine are common except those calibrations listed below.	2.3L CFI	ACT Sensor	E1AZ-12A697-A	DY-304
		ECT Sensor	E1AZ-12A648-A	DY-303
		Dist. Assy.	E43Z-12127-C	DA-1953
		Air Cleaner Vacuum Motor Assy.	E53Z-9D612-A	CX-1025
		Thermactor Check Valve	E3FZ-9A487-B	CX-772
		MAP Sensor	E43Z-9F479-B	DY-430-A
		EVP Sensor	E5AZ-9G428-A	CX-1000
5-25C-R01		EGR Valve	E53Z-9F483-A	CX-990
		Dist. Retard Control Valve	E3AZ-12A208-F	DY-412
		Air Cleaner Temp. Sensor	D7FZ-9E607-B	CX-122
5-25C-R01 5-25F-R10		EGR Valve Dist. Retard Control Valve	E53Z-9F483-A E3AZ-12A208-E	CX-990 DY-433
		Air Cleaner Temp. Sensor	D7DZ-9E607-A	CX-146
5-26E-R0 5-26E-R10 5-26E-R21		Dist. Retard Control Valve	E3AZ-12A208-E	DY-433
		Air Cleaner Temp. Sensor	D7DZ-9E607-A	CX-146
		EGR Valve	E53Z-9F483-B	CX-991
5-26J-R01 5-26J-R11		Dist. Retard Control Valve	E3AZ-12A208-C	DY-421
		Air Cleaner Temp. Sensor	D7DZ-9E607-A	CX-146
		EGR Valve	E53Z-9F483-B	CX-991

1985 (Cont'd.)

CALIBRATION CODE NUMBER	ENGINE	PART NAME	FORD PART NUMBER	MOTORCRAFT PART NUMBER
All parts listed for this engine are common except those calibrations listed below.	3.8L CFI	Thermactor Pump	E3SZ-9A486-C	CX-905
		EGR Valve	E4AZ-9F483-A	CX-932
		MAP Sensor	E5SZ-9F479-A	DY-495
		EVP Sensor	E43Z-9G428-B	CX-863-A
5-16A-R05 5-16A-R10		Thermactor Check Valve	D9AZ-9A487-C	CX-385
4-16B-R10		ACT Sensor	E1AZ-12A697-A	DY-304
		Dist. Assy.	E4ZZ-12127-A	DA-1965
		Air Cleaner Temp. Sensor Override	D7ZZ-9E862-A	CX-150
		Air Cleaner Vacuum Motor Assy.	E1SZ-9D612-A	CX-519
		Air Cleaner Temp. Sensor	D7FZ-9E607-B	CX-122
		Thermactor Check Valve	E3TZ-9A487-A	CX-760
5-16B-R05		ECT Sensor	E1AZ-12A648-A	DY-303
		Thermactor Control Valve ①	E4SZ-9F491-A	CX-935
		NOTE: Use calibration 4-16B-R10 for other component information.		
5-16B-R06 5-16B-R07 5-16B-R11 5-16B-R10 5-16F-R0 5-16F-R06 5-16F-R07		ACT Sensor	E1AZ-12A697-A	DY-304
		ECT Sensor	E1AZ-12A648-A	DY-303
		Dist. Assy.	E4ZZ-12127-A	DA-1965
		Air Cleaner Temp. Override	D7ZZ-9E862-A	CX-150
		Air Cleaner Vacuum Motor	E1SZ-9D612-A	CX-519
		Air Cleaner Temp. Sensor	D7FZ-9E607-B	CX-122
		Thermactor Control Valve	E4SZ-9F491-A	CX-935
		Thermactor Check Valve	E3TZ-9A487-A	CX-760

① LTD/Marquis Requires: D9AZ-9A487-C (CX-385)

CALIBRATION CODE NUMBER	ENGINE	PART NAME	FORD PART NUMBER	MOTORCRAFT PART NUMBER
All parts listed for this engine are common except those calibrations listed below.	5.0L CFI	ACT Sensor	E1AZ-12A697-A	DY-304
		ECT Sensor	E1AZ-12A648-A	DY-303
		Dist. Assy.	E5TZ-12127-B	DA-1970-A
		MAP Sensor	E43Z-9F479-B	DY-430-A
		EVP Sensor	E43Z-9G428-B	CX-863-A
		Thermactor Air Bypass Valve	E1TZ-9B289-C	CX-560
4-22F-R10		Air Cleaner Vacuum Motor	D7TZ-9D612-B	CX-120
		Air Cleaner Temp. Sensor	D7FZ-9E607-B	CX-122
		Thermactor Check Valve ②	E3TZ-9A487-A	CX-760/385
		Thermactor Pump	E1AZ-9A486-A	CX-624
		EGR Valve	E5AZ-9F483-A	CX-960-A
		Thermactor Control Valve	E3TZ-9F491-A	CX-899/948
5-22D-R0 5-22D-R10 5-22D-R11		Air Cleaner Vacuum Motor	D7TZ-9D612-B	CX-120
		Air Cleaner Temp. Sensor	D7FZ-9E607-B	CX-122
		Thermactor Check Valve ②	E3TZ-9A487-A	CX-760/385
		Thermactor Pump	E3ZZ-9A486-E	CX-895
		EGR Valve	E5AZ-9F483-A	CX-960-A
		Thermactor Control Valve	E3TZ-9F491-A	CX-899/948

② Check Valve with nipples at both ends D9AZ-9A487-C (CX-385)

CALIBRATION CODE NUMBER	ENGINE	PART NAME	FORD PART NUMBER	MOTORCRAFT PART NUMBER
5-22B-R0	5.0L CFI (Cont'd.)	Dist. Retard Control Valve	E3AZ-12A208-1	DY-431
		Air Cleaner Vacuum Motor	D7TZ-9D612-B	CX-120
		Air Cleaner Temp. Sensor	D7FZ-9E607-B	CX-122
		Thermactor Control Valve	E1AZ-9F491-A	CX-537
		Thermactor Check Valve ②	E3TZ-9A487-A	CX-760
		Thermactor Pump	E1AZ-9A486-A	CX-624
		EGR Valve	E5PZ-9H473-B	CX-1024-A
4-22C-R0 4-22B-R0		Dist. Retard Control Valve	E3AZ-12A208-D	DY-431
		Air Cleaner Vacuum Motor	D7TZ-9D612-B	CX-120
		Air Cleaner Temp. Sensor	D7FZ-9E607-B	CX-122
		Thermactor Control Valve	E1AZ-9F491-A	CX-537
		Thermactor Check Valve ②	E3TZ-9A487-A	CX-760
		Thermactor Pump	E1AZ-9A486-A	CX-624
		EGR Valve	E5AZ-9F483-A	CX-960-A
4-22H-R0		Dist. Retard Control Valve	E3AZ-12A208-C	DY-421
		Air Cleaner Vacuum Motor	D7TZ-9D612-B	CX-120
		Thermactor Control Valve	E1AZ-9F491-A	CX-537
		Thermactor Check Valve ②	E3TZ-9A487-A	CX-760
		Thermactor Pump	E1AZ-9A486-A	CX-624
		EGR Valve	E5AZ-9F483-A	CX-960-A
5-22R-R0 (Cont'd. on next page)		Air Cleaner Vacuum Motor	D7TZ-9D612-B	CX-120
		Air Cleaner Temp. Sensor	D7FZ-9E607-B	CX-122
		Thermactor Control Valve	E4SZ-9F491-B	CX-948
		Thermactor Control Valves		
		Upstream	E3TZ-9F491-A	CX-899

② Check Valve with nipples at both ends D9AZ-9A487-C (CX-385)

CALIBRATION CODE NUMBER	ENGINE	PART NAME	FORD PART NUMBER	MOTORCRAFT PART NUMBER
5-22R-R0 (Cont'd.)	5.0L CFI (Cont'd.)	Downstream ②	E3TZ-9A487-A	CX-760
		Thermactor Pump	E3ZZ-9A486-E	CX-895
		EGR Valve	E5AZ-9F483-A	CX-960-A
4-22A-R13 5-22E-R10		Thermactor Check Valve	D9AZ-9A487-C	CX-385
		Air Cleaner Vacuum Motor	D7TZ-9D612-A	CX-106
		Thermactor Pump	E3ZZ-9A486-E	CX-895
		EGR Valve	E5AZ-9F483-A	CX-960A
		Thermactor Control Valve	E3TZ-9F491-A	CX-899/948
5-22A-R0 4-22A-R13		Thermactor Check Valve	E3TZ-9A487-A	CX-760
		Air Cleaner Temp. Sensor Override	D8BZ-9E862-A	CX-243
		Air Cleaner Vacuum Motor	D7TZ-9D612-A	CX-106
		Thermactor Pump	E3ZZ-9A486-E	CX-895
		EGR Valve	E5AZ-9F483-A	CX-960-A
		Thermactor Control Valve	E3TZ-9F491-A	CX-899/948
5-22I-R0		Air Cleaner Temp. Sensor	D8BZ-9E862-A	CX-243
		Thermactor Check Valve	E3TZ-9A487-A	CX-760
		Air Cleaner Vacuum Motor	D7TZ-9D612-A	CX-106
		Thermactor Pump	E3ZZ-9A486-E	CX-895
		EGR Valve	E5AZ-9F483-A	CX-960-A
		Thermactor Control Valve	E3TZ-9F491-A	CX-899/948
5-22L-R0 5-22L-R10		Air Cleaner Vacuum Motor	D7TZ-9D612-A	CX-106
		Thermactor Control Valves	E4SZ-9F491-B E3TZ-9F491-A	CX-948 CX-899
		Thermactor Check Valve	E3TZ-9A487-A	CX-760
		Thermactor Pump	E3ZZ-9A486-E	CX-895
		EGR Valve	E5AZ-9F483-A	CX-960-A

② Check Valve with nipples at both ends D9AZ-9A487-C (CX-385)

1986

CALIBRATION CODE NUMBER	ENGINE	PART NAME	FORD PART NUMBER	MOTORCRAFT PART NUMBER
6-07E-R0 6-08E-R0	1.9L EFI	ECT Sensor	E1AZ-12A648-A	DY-303
		Barometric Sensor	E3ZZ-12A644-A	DY-405
		Dist. Assy.	E6FZ-12127-E	DA-1889-A
		PIP Sensor	E5PZ-12A112-A	DU-30-A
		TP Sensor	E6FZ-9B989-A	CX-1120
		Injector Assy.	E6FZ-9F593-A	CM-4488
		Thermactor Check Valve	E3FZ-9A487-B	CX-772
		EGR Valve	E6FZ-9D475-A	CX-1129
5-06A-R0 6-06A-R10 5-05A-R0 6-05A-R11	2.3L Non-Turbo	ECT Sensor	E1AZ-12A648-A	DY-303
		Dist. Modulator Valve	E4ZZ-12A170-B	DY-454
		Dist. Assy. Air Cleaner	E59Z-12127-C	DA-1984
		Temp. Sensor	D7ZZ-9E862-A	CX-150
		Air Cleaner Vacuum Motor	E3FZ-9D612-A	CX-898
		Air Cleaner Temp. Sensor	D7FZ-9E607-A	CX-109
		Thermactor Control Valve	E4SZ-9F491-A	CX-935
		Thermactor Check Valve (w/Flare)	E5ZZ-9A487-A	CX-985
		Thermactor Check Valve (Hose Nipple Both Ends)	D9AZ-9A487-C	CX-385
		Thermactor Pump	E3ZZ-9A486-A	CX-775
		MAP Sensor	E43Z-9F479-B	DY-430-A
		EGR Valve	E4DZ-9D475-A	CX-950
5-05R-R10 6-05R-R0 6-06E-R01 5-05S-R01 5-05E-R0	2.3L Turbo	ECT Sensor	E1AZ-12A648-A	DY-303
		Barometric Sensor	E3ZZ-12A644-A	DY-405
		Dist. Assy.	E59Z-12127-C	DA-1984
		T-P Sensor	E6ZZ-9B989-A	CX-1135
		Injector Assy.	E5ZZ-9F593-A	CM-4351
		EGR Valve③	E5RY-9D475-B	CX-987
		(T-Bird/Cougar and Mustang) SVO EGR Valve	E4DZ-9D475-A	CX-950
5-25F-R10 6-26E-R0 5-25C-R01	2.3L CFI	ACT Sensor	E1AZ-12A697-A	DY-304
		ECT Sensor	E1AZ-12A648-A	DY-303
		Dist. Retard Control Valve④	E3AZ-12A208-E	DY-433

③Calibration No. 5-05E-R0 Use valve No. E4D7-9D475-A (CX-950)
④Calibration No. 5-25C-R01 Use valve No. E3AZ-12A208-F (DY-412)

1986 (Cont'd.)

CALIBRATION CODE NUMBER	ENGINE	PART NAME	FORD PART NUMBER	MOTORCRAFT PART NUMBER
5-25F-R10 (Cont'd.) 6-26E-R0 (Cont'd.) 5-25C-R01 (Cont'd.)	2.3L CFI (Cont'd.)	Dist. Assy.⑤	E63Z-12127-B	DA-2005-A
		Air Cleaner Vacuum Motor	E53Z-9D612-A	CX-1025
		Air Cleaner Temp. Sensor⑥	D7DZ-9E607-A	CX-146
		Thermactor Check Valve	E3FZ-9A487-B	CX-772
		EGR Valve⑦	E53Z-9F483-A	CX-990
		MAP Sensor	E43Z-9F479-B	DY-430-A
		EVP Sensor	E5AZ-9G428-A	CX-1000
6-19B-R0 6-19M-R0 6-20A-R0 6-20B-R0 6-20S-R0	2.5L CFI	ACT Sensor	E1AZ-12A697-A	DY-304
		ECT Sensor	E1AZ-12A648-A	DY-303
		Dist. Retard	E3AZ-12A208-E	DY-433
		Dist. Assy.	E63Z-12127-B	DA-2005-A
		Air Cleaner Vacuum Motor	E6AZ-9D612-C	CX-1116
		Air Cleaner Temp. Sensor	D7FZ-9E607-B	CX-122
		Thermactor Check Valve	E6AZ-9A487-B	CX-1122
		EGR Valve	E53Z-9F483-A	CX-990
		MAP Sensor	E6FZ-9F479-A	DY-503
		EVP Sensor	E5AZ-9G428-A	CX-1000
6-10A-R10 6-10B-R05 6-10A-R10 6-10C-R05	3.0L EFI	ECT Sensor	E1AZ-12A648-A	DY-303
		Dist. Assy.	E6AZ-12127-C	DA-2002
		TP Sensor	E6DZ-9B989-B	CX-1132
		Inj. Assy.	E5TZ-9F593-A	CM-4347
		MAP Sensor	E43Z-9F479-B	DY-430-A
		EGR Valve	E6AZ-9D475-B	CX-1125
5-16B-R11	3.8L CFI	Thermactor Check Valve	(Thunderbird/Cougar) E3TZ-9A487-A	CX-760
		Thermactor Check Valve	LTD/Marquis D9AZ-9A487-C	CX-385
		Thermactor Pump	E3SZ-9A486-C	CX-905
		EGR Valve	E4AZ-9F483-A	CX-932
		MAP Sensor	E5SZ-9F479-A	DY-495
		EVP Sensor	E4SZ-9G428-B	CX-863-A
6-16B-R02		ACT Sensor	E1AZ-12A697-A	DY-304
		ECT Sensor	E1AZ-12A648-A	DY-303
		Dist. Assy.	E6SZ-12127-C	DA-2004

⑤Calibration No. 5-05E-R0 Use Dist. Assy. E59Z-12127-C (DA-1984)
⑥Calibration No. 5-25C-R01 Use Sensor D7FZ-9E607-B (CX-122)
⑦Calibration No. 6-26E-R0 Use Valve E53Z-9F483-B (CX-991)

1986 (Cont'd.)

CALIBRATION CODE NUMBER	ENGINE	PART NAME	FORD PART NUMBER	MOTORCRAFT PART NUMBER
6-16B-R02 (Cont'd.)	3.8L CFI (Cont'd.)	Air Cleaner Temp. Sensor	D7ZZ-98862-A	CX-150
		Air Cleaner Vacuum Motor	E1SZ-9D612-A	CX-519
		Air Cleaner Temp. Sensor	D7FZ-9E607-B	CX-122
		Thermactor Control Valve	E4SZ-9F491-A	CX-935
		Thermactor Check Valve	E3TZ-9A487-A	CX-760
		Thermactor Pump Assy.	E3SZ-9A486-C	CX-905
		EGR Valve	E4AZ-9F483-A	CX-932
		MAP Sensor⑧	E43Z-9F479-B	DY-430-A
		EVP Sensor	E43Z-9G428-B	CX-863-A
6-22B-R0 6-22E-R0 6-22G-R0 6-22H-R0 6-22I-R0 6-22J-R0 6-22M-R0 6-22C-R0	5.0L EFI	ECT Sensor	E1AZ-12A648-A	DY-303
		Dist. Assy.	E6AZ-12127-D	DA-2010
		TP Sensor	E6AZ-9B989-C	CX-1133
		Injector Assy.	E6SZ-9F593-A	CM-4492
		Thermactor Control Valve	E3TZ-9F491-A	CX-899
		Thermactor Check Valve	E3TZ-9A487-A	CX-760
		Thermactor Pump	E6VZ-9A486-A	CX-1136
		EGR Valve	E6AZ-9F483-C	CX-1117
		MAP Sensor	E43Z-9F479-B	DY-430-A
		EVP Sensor	E5AZ-9G428-A	CX-1000
		Thermactor Bypass Valve	E1TZ-9B289-C	CX-560
6-21B-R0 6-21C-R0 6-21A-R0 6-22A-R0 6-22L-R0		Injector Assy	E6ZZ-9F593-A	CM-4491
6-23A-R0 6-22A-R0 6-22L-R0 6-22F-R0 6-22K-R0		Thermactor Pump	E3ZZ-9A486-E	CX-895
6-23A-R0 6-22D-R22		Dist. Retard Control Valve	E3AZ-12A208-C	DY-421

⑧Calibration No. 5-16A-R10 Use Map Sensor E5SZ-9F479-A (DY-495)

NOTES

1986 SERVICE PUBLICATIONS

order form

PUBLICATIONS	ITEM NUMBER	QUANTITY	UNIT PRICE	AMOUNT
SHOP MANUALS				
CARLINE GROUP A* (Lincoln/Ford/Grand Marquis)	365-126-86A		$28.00	
CARLINE GROUP B* (Continental/Mark VII/Thunderbird/Cougar/ LTD/Marquis/Mustang/Capri)	365-126-86B		28.00	
CARLINE GROUP C* (Escort/Lynx/EXP/Tempo/Topaz)	365-126-86C		28.00	
COMPLETE CAR SHOP MANUAL* (Except Escort/Lynx/EXP/ Tempo/Topaz)	365-126-86AB		54.00	
MERKUR XR4Ti SHOP MANUAL (Includes 1985 Base Manual)	FPS-12045-86		36.00	
CAR SERVICE SPECIFICATION BOOK	365-336-86		5.25	
LIGHT TRUCK SHOP MANUAL*	365-326-86A		28.00	
MEDIUM/HEAVY TRUCK SHOP MANUAL*	365-326-86B		28.00	
COMPLETE TRUCK SHOP MANUAL*	365-326-86AB		54.00	
CL-9000 SERIES SHOP MANUAL	365-339-86		80.00	
L-SERIES SHOP MANUAL	365-493-86		85.00	
AEROSTAR SHOP MANUAL	FPS-12046-86		40.00	
RANGER/BRONCO II SHOP MANUAL (1985 Base and 1986 Supplement Manual)	FPS-12013-86		56.00	
LIGHT TRUCK SERVICE SPECIFICATION BOOK	365-322-86		5.25	
MEDIUM/HEAVY TRUCK SERVICE SPECIFICATION BOOK	365-329-86		5.25	
TAURUS/SABLE SHOP MANUAL	FPS-12055-86		30.00	
CARGO TRUCK SHOP MANUAL	FPS-12056-86		84.00	
CAR WIRING DIAGRAMS				
1986 CAR WIRING AND VACUUM DIAGRAM BOOK	365-246-86		30.00	
ESCORT/LYNX	365-198A-86		4.00	
EXP	365-198C-86		4.00	
TEMPO/TOPAZ	365-198D-86		4.00	
MUSTANG/CAPRI	365-198E-86		4.00	
LTD/MARQUIS	365-198Z-86		4.00	
THUNDERBIRD/COUGAR	365-198L-86		4.00	
FORD/GRAND MARQUIS	365-198J-86		4.00	
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MARK VII	365-198F-86		4.00	
TAURUS/SABLE	365-198M-86		4.00	
TRUCK WIRING DIAGRAMS				
1986 TRUCK WIRING DIAGRAM BOOK	365-247-86		28.00	
AEROSTAR	365-198H-86		4.00	
RANGER/BRONCO II	365-198R-86		4.00	
BRONCO	365-198O-86		4.00	
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F150-350 SERIES	365-198S-86		4.00	
F600-800 SERIES (CAB)	365-198T-86		4.00	
F600-800 SERIES (COWL)	365-198U-86		4.00	
C-SERIES	365-198V-86		4.00	
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L-SERIES (DELIVERY)	365-198Y-86		4.00	
CL-9000 SERIES	365-198W-86		4.00	
CARGO TRUCK	365-198K-86		4.00	

**Includes Performance Specifications*

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LTD/MARQUIS	0336-505-86		6.75	
MERKUR XR4Ti	0336-501-86		15.75	
MUSTANG/CAPRI	0336-503-86		6.75	
ESCORT/LYNX, EXP	0336-502-86		6.75	
TEMPO/TOPAZ	0336-527-86		6.75	
LINCOLN	0336-509-86		15.00	
THUNDERBIRD/COUGAR	0336-506-86		7.75	
CONTINENTAL/MARK VII	0336-526-86		15.75	
ECONOLINE	0336-522-86		6.75	
BRONCO, F150/F350	0336-521-86		7.75	
RANGER/BRONCO II	0336-524-86		7.50	
AEROSTAR	0336-525-86		7.50	
TAURUS/SABLE	0336-512-86		6.75	
MISCELLANEOUS PUBLICATIONS				
1985 CAR & TRUCK ENGINE/EMISSION FACTS BOOK SUMMARY	365-489-85		20.00	
CAR & TRUCK EMISSION DIAGNOSIS, ENGINE/ELECTRONICS	365-126-326-86H		44.00	
CAR & LIGHT TRUCK TOWING PROCEDURES	365-334-86		3.50	
CAR LABOR TIME STANDARDS MANUAL	7189-C86		45.00	
LIGHT TRUCK & VANS LABOR TIME STANDARDS MANUAL	7189-L86		45.00	
MEDIUM/HEAVY TRUCK LABOR TIME STANDARDS MANUAL	7189-H86		45.00	
TSB BINDERS	365-199		9.50	
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